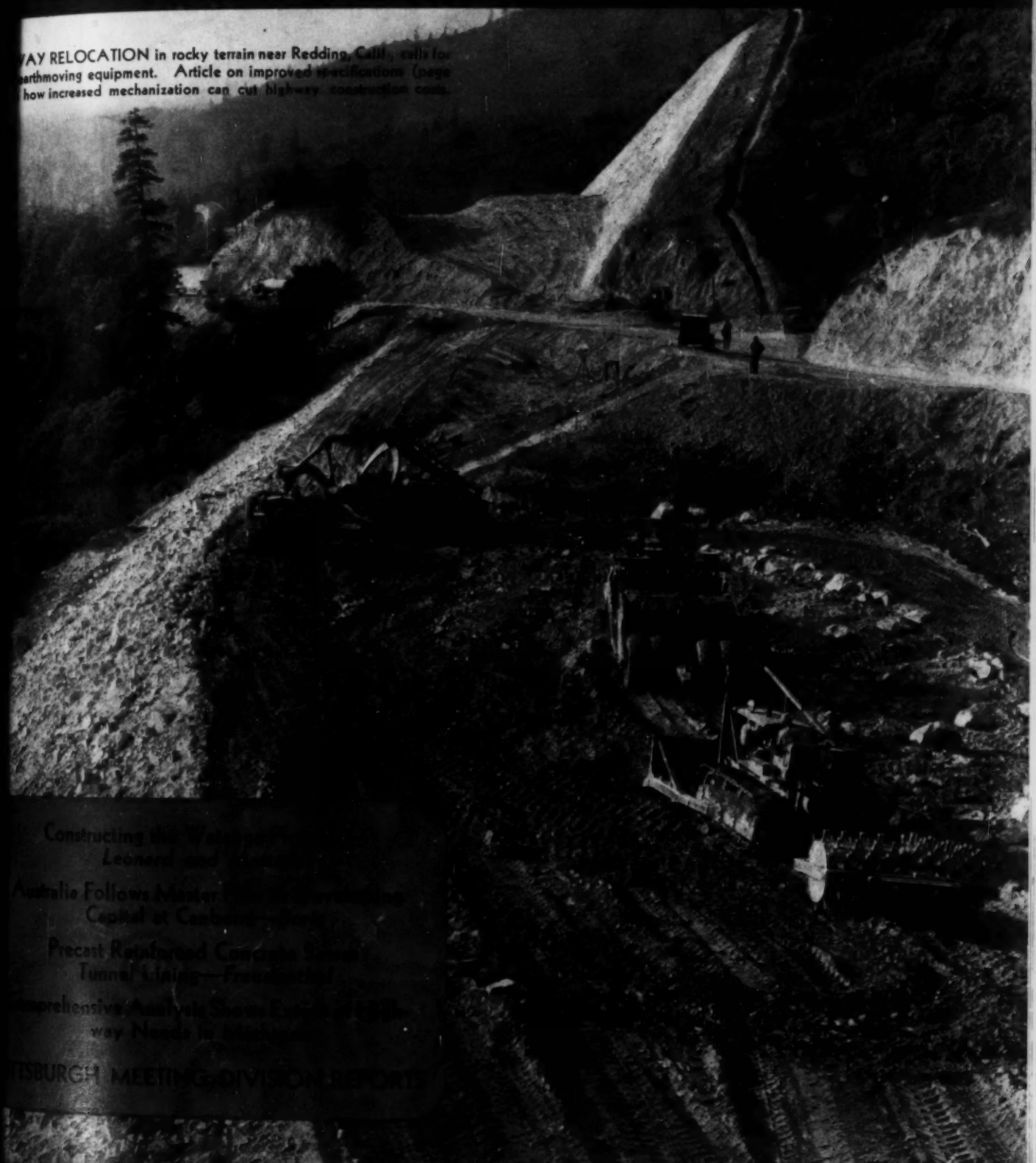
CIVIL ENGINEERING



WAY RELOCATION in rocky terrain near Redding, Calif., calls for earthmoving equipment. Article on improved specifications (page how increased mechanization can cut highway construction costs.

Constructing the Waterway
Leonard and

Australia Follows Master
Capital at Canberra

Precast Reinforced Concrete Segmental
Tunnel Lining—Free

Comprehensive Analysis Shows Extent of Future
way Needs in

TSBURGH MEETING—DIVISION

RAYMOND

51 YEARS

FOUNDED IN 1897

OF PROGRESS

RAYMOND

National, Local Subjects Discussed at ASCE Spring Meeting

EIGHT SESSIONS OF ASCE Technical Divisions held the attention of Society Members in attendance at the Spring Meeting in Pittsburgh, Pa., April 7–9. Papers presented during the three-day meeting covered a wide range of subjects of local and national interest.

Sessions of the Air Transport Division and the Structural Division and a joint program of the Sanitary Engineering and Hydraulics Divisions occupied Wednesday afternoon, April 7. Thursday morning was devoted to meetings of the Waterways, Highway, and Surveying and Mapping Divisions, and sessions of the City Planning and Construction Divisions completed Thursday's technical presentations.

Other talks on vital subjects presented during the Spring Meeting included an address by ASCE Executive Secretary William N. Carey on the role of the engineering profession in administration of the European Recovery Program, given before the Chamber of Commerce of Pittsburgh (see page 50 of this issue), and one prepared by Admiral Ben Moreell on "The Engineer and the Future" before the Wednesday luncheon meeting (see page 55).

Need for Planning of Civil Airports Stressed by Symposium Speakers

MORE THAN 90 percent of all civil airports have been conceived and developed without a clear picture of basic engineering requirements which would conduct economic surveys "to establish the ultimate use of the airport and its economic function in the community."

This fact was brought out in a symposium by members of a subcommittee, which has made an extensive study of airport terminal facilities, in a session of the Air Transport Division. Authors were: J. B. Bayard, Jr., St. Louis; G. Meredith Muscik, Denver; and H. P. Beach, Jr., Washington, D.C.

Lack of appreciation on the part of public officials of the impact of airports on community life, and collective apathy on the part of architects and engineers in performing the planning function where it is most needed in the first preliminary phase, were blamed by the speakers for the hodgepodge development of airports to date.

"Extensive publicity has been given to the development of large airports and their related problems," they pointed out. "Actually, however, the majority of airport and terminal facility design problems to be faced by engineers and architects in the next several years will be incidental to facilities serving medium and small size communities. Regardless of whether the engineer faces the problem of airport facilities for a region having great population concentrations or a small town, the basic planning considerations have to be established if a satisfactory result is desired."

Airports should be so planned, the symposium speakers asserted, that their terminal facilities, "although representing only a minor part of the total cost of an airport, can be properly conceived, developed and managed to produce the majority of the airport's revenue."

The public, it was emphasized, "gains its impression of the airport from the terminal facilities, and public support is essential for continuing airport development and improvement. Terminal facilities provide common meeting places for the air and ground services and, in addition, supply those conveniences and necessities expected by the air traveler and the general public normally attracted to transportation terminals."

Warning that "there does not appear to be a formula into which can be fitted a few items of easily obtained information and reduced to the plan of terminal facilities," the speakers described methods of establishing airport terminal facility requirements, the essentials to be considered in planning these facilities, the potentialities of these facilities for the production of revenue, and the general approach to the problem of effectuating the planned program. They recognized "an increasing appreciation of the contribution the airport terminal facilities make to the operational efficiency and economic success of the airport" by those officials responsible for the planning and development of public airports and a "desire on their part to give to this phase of airport development the thought and study it needs."

Three Papers Are Presented at Meeting of Structural Division

THREE PAPERS WERE presented at the meeting of the Structural Division. Leon C. Bibber, welding engineer, Carnegie-Illinois Steel Corp., Pittsburgh, discussed "Fundamental Effects of Welding and Other Thermal Fabrication Processes." Tappan Collins, director of research, Stran Steel Division, Great Lakes Steel Corp., Detroit, presented a paper, "New Developments in Design of Light-Gage Steel." The third paper was prepared jointly by Marshall Holt, Assoc. M. ASCE, and J. W. Clark, research engineers, Aluminum Company of America, New Kensington, Pa. It was entitled, "End Connections for Struts Evaluated by Static and Fatigue Tests on Aluminum Alloy Members."

The joint paper discussed an experimental investigation involving both static and repeated loadings as undertaken at Aluminum Research Laboratories to study the relative merits of various types of end connections for round-tubular struts, single-angle struts and double-angle struts.

In his paper, Mr. Collins told of the work being done in the field of developing specifications for the design

of light-gage steel members, notably a design manual being prepared by a subcommittee of the American Iron and Steel Institute. When published, this manual will reflect the combined best judgment of both the producing industries and the fabricating industries so far as it has been possible to develop that combined judgment, Mr. Collins said, adding:

"So far as it is possible to define the material of a forthcoming publication before any final draft has been endorsed by the organization which proposes to publish it, here is an outline of what this design manual will include:

"A general interpretation of design considerations, with extensive excerpts from the design specification.

"Presentation of a useful series of basic sections whose design properties will be tabulated in full, with some provision for their limited extension by interpolation and extrapolation.

"Explanation of a simplified method for evaluating the properties of any proposed light-gage cold-formed section, including reference aids.

"Improved charts for the direct graphic determination of the effective width ratio of any stiffened compression element.

"A wholly new chart by which the allowable axial compressive stress for any light-gage cold-formed column may be most conveniently determined.

"Examples illustrating the application of the foregoing specific problems.

"Standards for the design of well-braced panels in which the columns or studs are cold-formed."

Engineer-Contractor Cooperation Urged to Resist Mounting Costs

RESISTANCE TO "the evil of rising prices" in the construction industry, through closer cooperation between engineers and contractors who can "eliminate non-essentials and fineries for appearances' sake" and thus stretch the construction dollar as far as it will go, was urged before the Construction Division.

Lower costs can be achieved through clear, concise specifications which give bidders foreknowledge of specific requirements, rather than leave many items to the discretion of the engineer, D. W. Winkelman, Syracuse, N.Y., president of the Associated General Contractors of America, Inc., asserted in a paper read in his absence by Burt LeRoy Knowles, M. ASCE, field engineer, Associated General Contractors of America, Inc., Washington, D.C.

While stating that he felt his proposals for closer cooperation between the men who design works of construction and the men who build them are applicable in all branches of the construction industry, Mr. Winkelman particularly emphasized need for attention to the problem in the highway field.

"Specifications should be definite enough to set forth clearly the details and character of the construction, yet flexible in interpretation and application in order not to work a hardship on the contractor," he said. "Results should be specified, not methods. All refinements, especially hand labor, which add cost but contribute nothing to the utility of the construction, should be eliminated. Standardization of many materials and some details of design should be effected, particularly in states having similar climatic, geographic and other conditions." (Mr. Winkelman's paper appears on page 28 of this issue.)

In other papers presented before the Construction Division, Orval Auhl, general superintendent, construction division, Dravo Corp., Pittsburgh, discussed "Bluestone Dam, Hinton, W.Va." (to be reported in detail in a future issue of CIVIL ENGINEERING) and S. L. Fuller, M. ASCE, president, John F. Casey Co., Pittsburgh, spoke on "Edgewood Underpass, Penn-Lincoln Highway."

City Planners Warned Public Footing Bills Must Understand Projects

ENGINEERS MUST STOP planning in ivory towers and be more conscious of the public interest in their work and of the fact that the public provides the funds for implementation of their plans, it was emphasized at a session of the City Planning Division.

Urging the engineers to "rescue planning from futility," Park H. Martin, M. ASCE, Pittsburgh, executive director of the Allegheny Conference on Community Development, discussed the work of the Conference in coordinating the planning activities of various organizations and governmental units in the Pittsburgh area. Mr. Martin said:

"Most cities are alike in that their files are full of plans that have been drawn, presented, and then filed away to gather dust because either the plans had not been coordinated with a program or implementation of the plans had not been considered as a part of planning. Such failures of implementation have often given rise to a sense of futility in planning. Here our purpose is to stimulate and coordinate research and planning looking toward a unified community plan for the region as a whole; to secure by educational means public support of the projects that are approved by the Conference as parts of that over-all, unified plan, and to see that something is done to bring about the fulfilment of the plans. Its ultimate objective is to maintain the Allegheny region as a well-adjusted, healthy, social organism, able to provide its citizens with conditions essential to good living."

Mr. Martin described the Conference as a privately financed organization which is utilizing existing agencies in so far as possible and supplementing their work for the good of the community. Interests center in cultural development; health, welfare and recreation; land use and zoning; employment; economic problems; housing and neighborhood development; highways; parking; stream pollution abatement; water supply; mass transportation; refuse disposal; smoke abatement, and research coordination, he said.

"The importance of industrial production and employment to community planning and development is too often overlooked," Mr. Martin said. "Community planning concerns people; people live where they have jobs."

Emphasizing the need for public understanding of the work of planners, Mr. Martin pointed to the passage of needed state legislation as one of the Conference's outstanding achievements, accomplished through thorough and painstaking explanation of the problems involved to the

affected people. This legislation, he said, enabled planning to proceed even along such controversial lines as smoke abatement and parking operations.

Warning that development of "an understanding of human values and social problems" is needed if plans of engineers are to be implemented, Mr. Martin said: "As engineers and planners we cannot set ourselves apart and plan in ivory towers. We should be more conscious of the fact that there is a public interest in the work we do, that the public provides the funds if the plans are to be accomplished, and therefore we should see that there is public understanding and acceptance of the plans and programs."

"The Pittsburgh Master Guiding Plan," was the subject of a paper presented by Frederick Bigger, chairman of the Pittsburgh City Planning Commission. A third paper, entitled "Development of Pittsburgh Central District," was presented by Wallace Richards, executive director of the Pittsburgh Regional Planning Association.

Streamlined Surveys Increase Cities' Service, Mapping Group Is Told

HARD PRESSED FOR finances and faced with planning problems resulting from urban decentralization, American cities are discovering that streamlined methods of making municipal surveys not only increase efficiency and service, but help locate untaxed land.

This was brought out in a symposium conducted before the Surveying and Mapping Division in papers by Charles B. Taylor, director, Pittsburgh City Survey; Prof. G. Brooks Earnest, M. ASCE, of Case Institute of Technology, consulting director, Cleveland Regional Geodetic Survey; and Virgil Kauffman, president, the Aero Service Corp., Philadelphia.

Pointing out that ground surveys are necessarily slow and their cost large, with information obtained piecemeal over a period of many years, Mr. Kauffman described mapping by photogrammetry and cited a report covering Cleveland:

"It points out that it had taken four years to complete 12 square miles of mapping and that at this rate it would take 150 years to map Cuyahoga County at a cost of approximately $6,000 per square mile, or a total of $3,339,900. This is then compared with the cost and time estimate for performing the work by photogrammetric methods, which would do the job in slightly more than three years, with that time cut in half by double shifts, if necessary, for a total cost of $1,440,000—43 percent of the ground costs with a time schedule 50 times faster."

Mr. Kauffman warned the engineers against assuming that civic leaders, who must be shown the need for improvements before they can be sanctioned by the taxpayers who foot the bill, can read maps as easily as engineers. He asserted that aerial photographs offer a "simplified and more understandable presentation for the lay audience."

Speaking of the work cities are doing in replanning due to urban decentralization, Mr. Kauffman said:

"In most cities, property surveys are difficult because of inaccuracies in surveys made over a long period of time and because of errors in deed records. Large-scale mosaics add greatly in finding these errors. With the mosaic as a base map, almost any group of deeds can be plotted on a transparent overlay. Much field work can thus be saved. Large-scale mosaics may pay for themselves many times over in finding untaxed land."

The other speakers also emphasized savings to be effected. Mr. Taylor said:

"The total eventual savings in dollars inherent in such surveys is not possible to compute, but by providing an accurate inventory of existing conditions, intelligent planning can be carried on in such a comprehensive manner that in Pittsburgh we expect to save the cost of the survey in not too many years. Like private business, which finds it profitable to keep a record of what material is on hand, cities will not only find it profitable to do likewise, but the up-to-the-minute information will increase the efficiency of service to the public."

Calling the Cleveland Regional Geodetic Survey "one of the most unique ever attempted," Professor Earnest described the cooperative effort sponsored by state, county and city organizations:

"What had been a seemingly insurmountable obstacle of financing the project is being overcome by the following simple expedient: The various public agencies which derive the greatest benefit provide sponsorship in the form of personnel, equipment, supplies, materials and essential office space and equipment storage space. When completed, the Cleveland Survey will provide control for an area approximating 450 sq miles, about one-third of it within the city's bounds. The total cost of the survey should not be averaged over the years of duration, for it must be remembered that the control, when established, will benefit the city and the county for many years to come."

Navigation Locks Discussed Before Waterways Division Session

SPONSORED BY ITS Committee on Design, Construction, and Operation of Navigation Locks and Dams, the Waterways Division session centered around four papers.

The early history of navigation locks and the development and use of cofferdams were discussed by Carl B. Jansen, M. ASCE, president, Dravo Corp., Pittsburgh, in a talk on construction methods. Stating that the high-lift dams of today are gradually replacing earlier structures, Mr. Jansen pointed out that the additional quantities of concrete masonry required in modern construction and the extremely heavy gates and operating machinery have necessitated a radical change in the equipment used and in worker skills.

"An extremely important element that has tended to bring about radical changes and economies in the construction of these marine structures has been the transition from day labor to the contract method," he said. "The design of cofferdams—and for that matter of all plants engaged on the work—has been stimulated by the social upheaval of the present century. With hand labor cheap and plentiful and the volume of equipment on the job at a minimum, it was not considered impractical to build a low-head cofferdam which would hold out the river at normal stages . . . and during the so-called high-water periods, to permit the overtopping and flooding of the cofferdam and shut down the

work until the river returned to normal.

"As the supply of labor decreased and the rate of pay increased," Mr. Jansen continued, "the types and cost of equipment on the job improved and increased, and the consequent overhead carrying through such idle periods could not be borne. Further, working men everywhere refused to continue to make themselves available on work where long periods of unemployment might be anticipated. These conditions, developing concurrently with the incentives of the contract method, brought about an intense interest in correcting this situation."

Other papers were by C. E. Blee, M. ASCE, chief engineer, TVA, Knoxville, whose subject was "Gates and Bulkheads at Navigation Locks for Emergency Closures and Unwatering Operations"; A. F. Griffin, Assoc. M. ASCE, chief engineer, Upper Mississippi Valley Division, Corps of Engineers, St. Louis, Mo., who presented a paper, "Influence of Model Testing in the Developing of Lock Hydraulic Systems"; and Ralph L. Bloor, M. ASCE, chief of the Engineering Division of the Corps of Engineers, Washington, D.C., who discussed "Lock Sizes." Harry Wiersema, M. ASCE, Knoxville, read Mr. Blee's paper.

Sanitary Engineering and Hydraulics Divisions Meet

AT A JOINT session of the Sanitary Engineering and Hydraulics Divisions, four papers were read.

Prof. Elmer A. Holbrook, dean, School of Engineering and Mining, University of Pittsburgh and a member of the Pennsylvania Sanitary Water Board, presented a paper, "Western Pennsylvania Pollution Abatement Program." John F. Laboon, M. ASCE, Pittsburgh consulting engineer and chairman of the Allegheny County Sanitary Authority, spoke on "Allegheny County Sanitary Authority Sewerage Project." Prof. John H. Dawson, Pennsylvania State College, gave a paper, "Visualization of Flow with Fluid Polariscope."

A fourth paper, "Waste Pickle Liquor Neutralization," was presented by Richard D. Hoak, senior fellow, Mellon Institute of Industrial Research, Pittsburgh.

"Disposal of the acidic liquor resulting from the removal of oxide scale from many steel products in the course of their manufacture is a problem of considerable magnitude," Mr. Hoak pointed out in his paper. "The numerous by-product recovery processes that have been proposed have been designed principally for very large operations, and the producers will normally have no alternative but neutralization with some alkaline agent."

Mr. Hoak outlined the basic principles of neutralization and discussed economic factors.

Highway Division Hears Papers on Penn-Lincoln

A SYMPOSIUM ON the Penn-Lincoln Highway at Pittsburgh marked the meeting of the Highway Division.

A description and objectives of the project were presented by E. L. Schmidt, chief engineer, Pennsylvania Department of Highways, Harrisburg, Pa. The intricate Downtown Interchange was the subject of a paper by George S. Richardson, M. ASCE, Pittsburgh consulting engineer, and Ole Singstad, M. ASCE, New York City consultant, described the Squirrel Hill Tunnel portion of the project.

The highway papers elicited considerable discussion, particularly among Pittsburgh members.

Rotary Drill Makes Fast Work of Concrete Core Boring Job

PERFECTLY CORED 6 1/4-in.-dia hole is cut in 3 ft of concrete pavement in just 25 minutes by rotary concrete drill (below, left) mounted in special rig. Holes drilled for anchoring of new 26-ft-high lighting standards in Hollywood's famous "Radio Row" passed through remnants of former light posts, cable, steel pipe and electrical conduit. Cutting of one hole squarely through center of upright piece of pipe (below, right) slowed operation to one hour. Drills, hand made from cold rolled steel by Rotary Concrete Drill Co. of Pasadena, Calif., have specially heat-treated cutters set in and brazed to end of bit shaft. Bits are capable of drilling as many as 3,000 holes without sharpening.

WATAUGA RIVER enters 34-ft-dia diversion tunnel at upstream toe of dam. Crushed-rock filter blanket separates impervious earth core from quarry-run rock. Control tower for low-level sluices and morning-glory spillway are seen in background.

Constructing the Watauga Project

A Flood Control and Power Project of the Tennessee Valley Authority

GEORGE K. LEONARD, M. ASCE
Project Manager, Watauga Project, TVA; Formerly Chief, Project Planning Division, TVA

and

DON H. MATTERN, M. ASCE
Head, Project Investigations Section, TVA

A previous article, "Planning the Watauga Project," appeared in CIVIL ENGINEERING for March 1948. This second article describes the principal structures and some of the unusual construction problems.

CRITICAL WAR MATERIAL was still short at the time construction of Watauga Dam was resumed in July 1946. Lumber was especially scarce, chiefly because of the veterans' housing program which was in full swing. To avoid the use of commercial lumber, over two million feet of construction lumber was sawed from logs cut on reservoir lands, most of which would eventually be cleared.

Fortunately, the job construction buildings had been finished in 1942. These included warehouses, shops, personnel building, hospital, and administration building. However, the postwar housing shortage in 1946 made it necessary to provide housing for construction personnel which had not been necessary in 1942. Enough buildings of all types were found at completed TVA projects, some as far away as 175 miles. These were sectionalized, moved on trucks, and reerected. At the damsite, the con-

LARGEST CONSTRUCTION BLAST on record, using over 526,000 lb of explosive agent, loosens 800,000 cu yd of rock. ASCE members attending Fall Meeting of Tennessee Valley Section (below, left) witness record blast. Broken rock in foreground of view looking upstream (below, right) is part of rockfill material produced by blast.

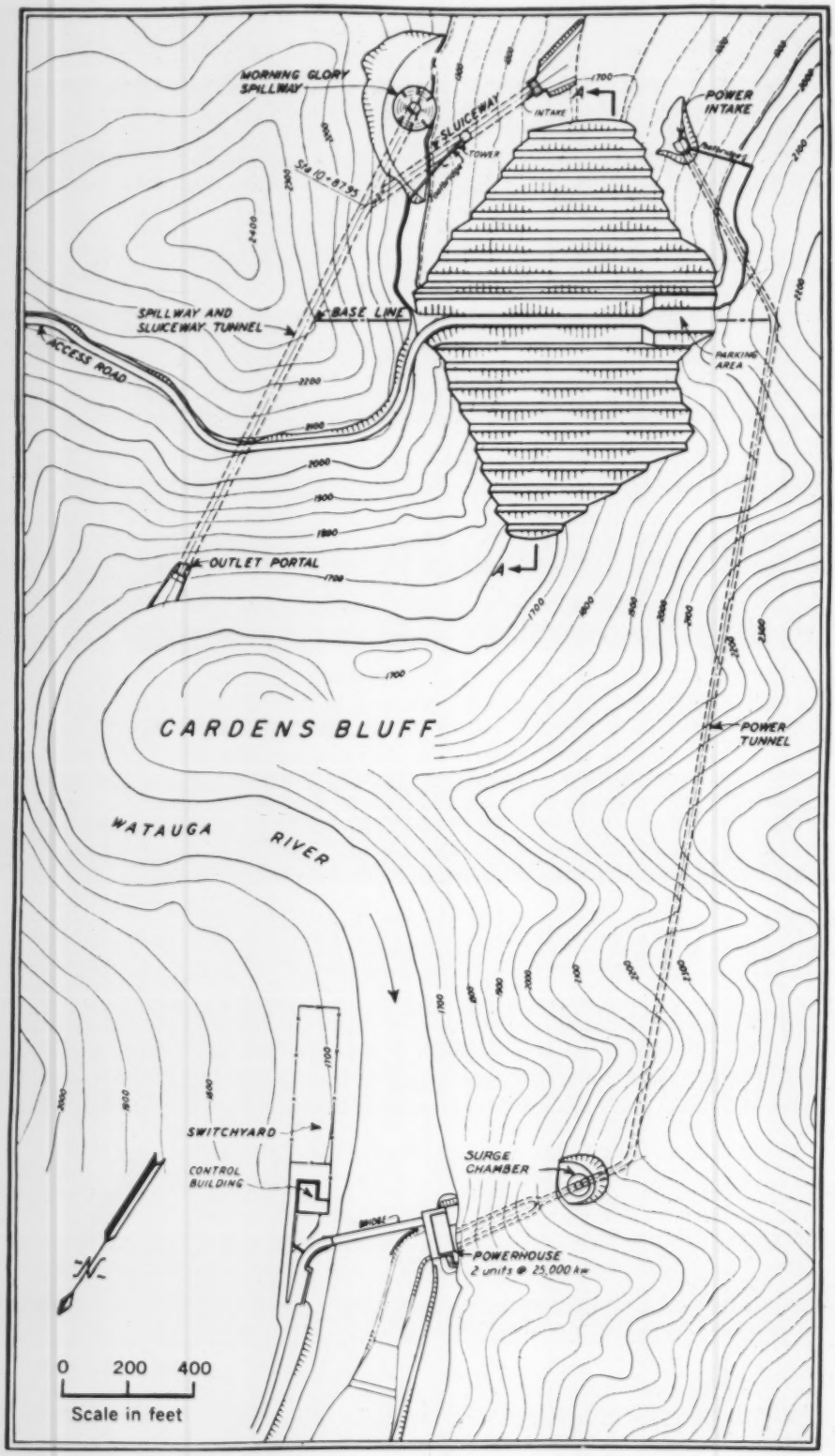


FIG. 1. WATAUGA DAM LOCATION takes full advantage of geologic conditions at site. Earth and rock fill structure, 320 ft high, is located so that entire base rests on massive unweathered quartzite. Large fault passes under upstream rock fill. Plan shows topography of area and main features of structure.

struction camp included dormitories, recreation buildings, and a mess hall for 400 men; in Elizabethton, 8 miles away, 61 houses and 34 trailers were erected.

Watauga Dam (Fig. 1) will be one of the highest earth and rock fill structures in the country, having a maximum height of about 320 ft from the foundation to the top at El. 1998. The dam will have a crest approximately 900 ft long, a top width of 32 ft, and side slopes that average 2 horizontal to 1 vertical. There will be a 14-ft-wide berm 30 ft below the top of the dam on both the upstream and downstream sides. Below this elevation, there will be 18-ft-wide berms at 30-ft intervals. The 1.4-to-1 slope between berms was designed to approximate the natural slope of the rock when dumped from end-dump trucks.

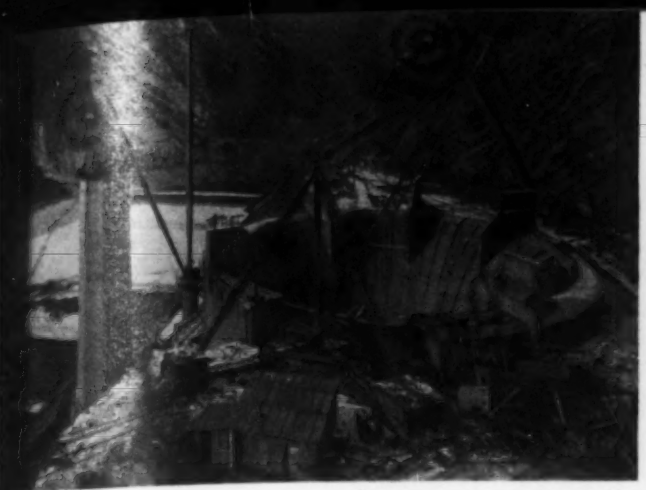
Excellent Site for High Dam

Full advantage was taken of geologic conditions in locating the dam. As a result, foundation preparation under the earth core was quite simple and covered only a small part of the base area. Of major importance is the Iron Mountain fault which passes through the site. It is one of the major thrust planes lying along the northwest front of the Blue Ridge Mountains, and along it the older rocks of the mountains have been thrust upward and northwestward for several miles over the much younger (dolomite) rocks. The strike of the fault at the site is N 52 deg E, almost the same as the bedding and bearing of the dam's baseline. Its dip is 42 deg to the northwest, again almost the same as the bedding.

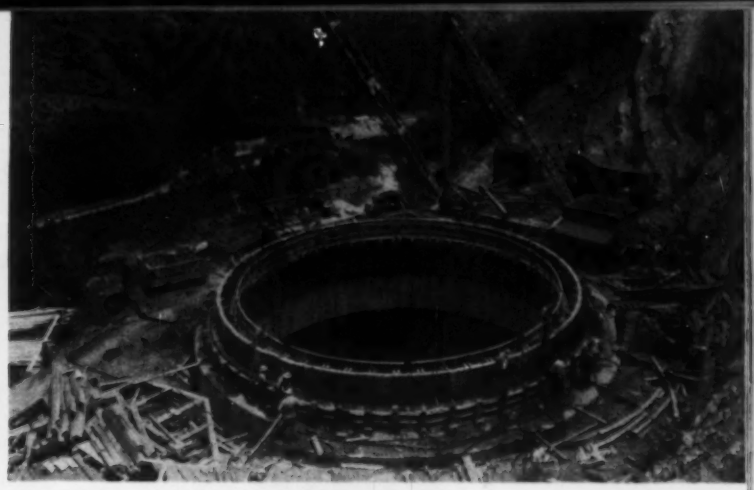
The dam was located so that at the river bed the fault passes under the upstream rockfill, thus placing the soluble dolomite upstream from and far below the dam. All rock downstream from the fault is hard, brittle quartzite with an occasional interbed of argillite, a rock intermediate between true shale and slate. Such a shale bed (known locally as Unit 2) passes through the river bed just above the baseline of the dam. This insoluble, fairly impermeable bed about 12 ft thick formed a natural seal against leakage. No cutoff trench was required and it was only necessary to consolidate the top 30 ft with a simple low-pressure grouting operation.

This location placed the entire base of the dam on massive, unweathered quartzite, requiring only the removal of the overburden and loose rock from the abutment slopes and river bed. On the left slope, the cover was thin, but the base of the right side was overlaid with talus from 6 to 60 ft deep. The talus consisted mostly of sand, gravel, and boulders, some of the latter being so large that they could have been mistaken for bedrock. Some 240,000 cu yd of this material was removed.

The bedrock was thoroughly cleaned under the earthfill portion, but under the two rockfills it was



MORNING-GLORY SPILLWAY has 128-ft-dia entrance which permits uncontrolled flow into tunnel 307 ft below. Control gates will be installed in 280-ft tower.



ON SURGE CHAMBER PLAZA, far above Watauga River, workmen prepare for one of early pours of 60-ft-dia shaft lining. Concrete work closely follows chamber excavation.

TABLE I. CHARACTERISTICS OF BORROW-PIT MATERIAL FOR PENETROMETER READING OF 400 PSI

Class	Description	Internal Friction Angle, Deg	Maximum Placing Moisture, Percent of Dry Weight	Optimum Moisture, Percent of Dry Weight	Dry Density at Optimum Moisture, Lb per Cu Ft
I	Lean to silty clay and fine gravel	33.0	30.6	26.0	94.0
II	Medium to lean clay and fine gravel	24.6	27.4	22.5	100.2
III	Lean clay and fine gravel	25.8	23.6	19.0	105.3
IV	Lean clay and fine gravel	30.6	23.0	16.6	108.7
V	Silty clay to sandy clay	34.8	19.7	15.8	112.2
VI	Clayey sand to sand	36.0	17.1	12.5	117.4

necessary to clean only enough to allow the large quarry-run rock to have contact with the bedrock.

The dam will contain approximately 1,500,000 cu yd of impervious rolled earthfill, about 1,750,000 cu yd of quarry-run rock, and 250,000 cu yd of crushed stone used as a filter between the earth and rock fills. Approximately half of these quantities is now in place.

Sufficient material for the impervious rolled fill was available within $2^1/_2$ miles of the dam, but the high natural moisture content made it difficult to control. Because of the location of the borrow pits, the high water table, and capillary action, the moisture in the natural ground was well above the optimum, ranging from 17 to 43 percent by dry weight, depending on the type of material. To obtain a moisture content low enough to give proper compaction and the required shear values, it was necessary to open four large borrow pits and move from one to another as the material in each became satisfactory for use in the fill. Plowing and then aerating the earth, followed by removal in 18-in. cuts proved to be the best procedure for effective use of the borrow pits. Even light rains, which were quite frequent during the summer, raised the moisture in the pits and fill to an unusable high percentage, often requiring a lay-off of several days while evaporation took place.

The material varied from clay to sand, and occurred in both residual and alluvial deposits. Class numbers were assigned to six ranges of dry densities for convenience in both control and reporting daily test results. As a practical means of controlling the rolling operations, a penetrometer was used. Material giving a minimum penetrometer reading of 400 psi rolled well, reduced laminations, and produced the desired shear strength. A smaller penetrometer reading tended to lower these standards. Table I shows the characteristics of the six classes. Class VI material was placed only in the downstream half of the fill because of its higher permeability.

Daily tests of dry density and direct shear were made during the placing of the rolled fill. The average values of density, angle of internal friction, and cohesion to date are 101 lb per cu ft, 30.5 deg, and 0.49 ton per sq ft, respectively. Permeability is low. These values satisfy design requirements.

The transition filter between the earth core and the rockfills [Fig. 2 (*a*)] consists of an 8-ft-thick layer of a

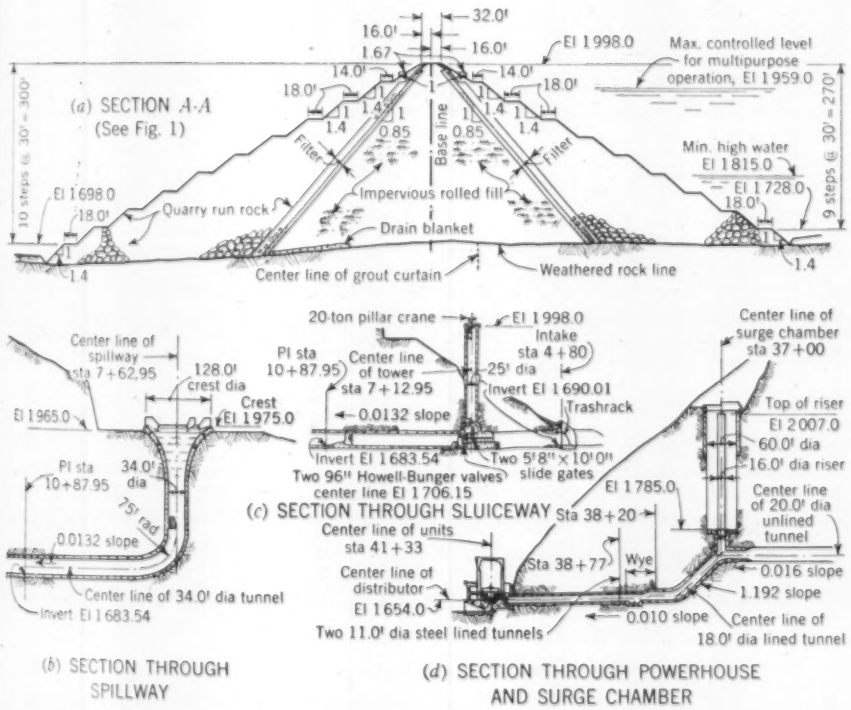
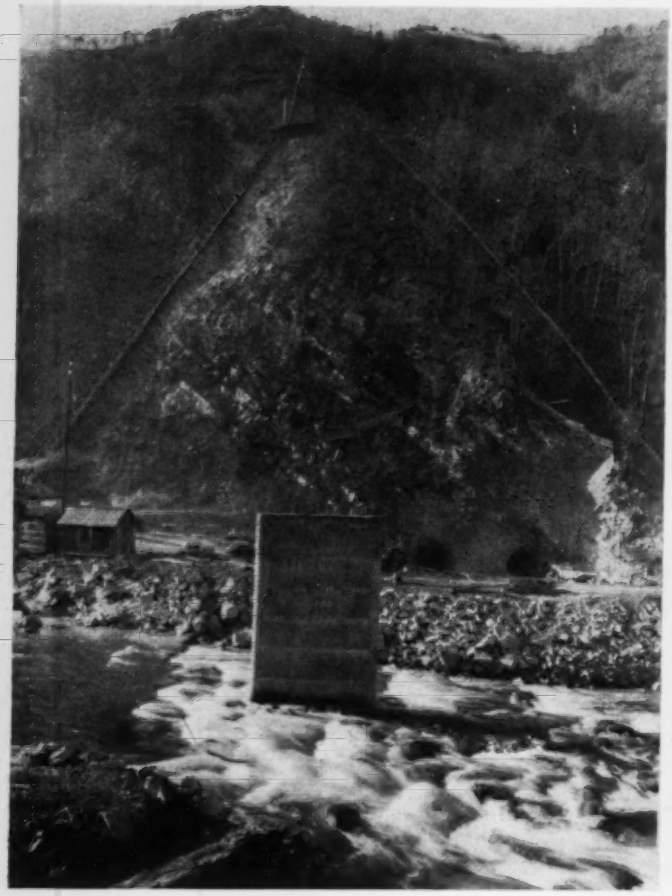


FIG. 2. SECTION THROUGH DAM (*a*) shows impervious rolled-earth fill, quarry-run rock and filter between earth and rock fills. Design features of spillway, sluiceway, powerhouse and surge chamber are shown in parts (*b*), (*c*) and (*d*).



STEEL PENSTOCKS (above, left) emerge from two power tunnels located in mountain behind powerhouse cofferdam. Inclined railway leads to surge-shaft plaza 370 ft above river. Pier in foreground will support permanent access bridge to powerhouse area. Relocation of Tennessee State Highway 67 (above, right) will cross reservoir on bridge 270 ft above present river.

mixture of crushed rock and sand graded from dust to $1^1/_4$ in. against the core, followed by a 12-ft-thick layer of crushed rock graded from dust to 12 in. against the quarry-run rockfills. The gradation of the finer transition filter was designed to allow proper drainage of the impervious core and at the same time to prevent the core material from washing through.

Using a Euclid loader and bottom-dump trucks of 16-cu yd capacity, a production of 60 loads per hour was about normal. This amounted to 630 cu yd of compacted fill.

Quarry Rock Very Hard

Quarry-run rock for the dam is being obtained from the steep mountainside on the left bank of the river immediately downstream from the toe. It is divided by the bedding and jointing planes into blocks of ideal size for easy handling with power shovels after loosening by explosives.

Because of the proximity of the quarry to the dam, it was not feasible to plan on shooting all of the rock to a single floor near the bed of the river since this procedure would have made the grades on the haul roads too steep. The quarry site, accordingly, was divided into three parts, with quarry floors located at Els. 1,690, 1,750, and 1,950. The rock from each floor could then be hauled into the dam on easy grades.

During the initial operations on the drill roads with wagon drills, drifters, and stopers, it was found that the quartzite was exceedingly hard (No. 7 on Moh's scale) and abrasive. This was later confirmed when the well drilling started for the blast holes. Drilling progress was very slow, the average depth of hole drilled per bit dressing being less than 1.5 ft. The principal difficulty was the loss of gage on the bit due to the abrasiveness of the quartzite. As many as 12 bits per shift were used in an effort to drill the hole full size before the gage was lost. If a bit was used after the gage was lost, several succeeding bits were necessary before the hole could be made full size. Factory representatives and metallurgists were consulted, and many different methods for dressing and tempering the bits were tried without success. It was jokingly suggested by one of the steel experts that drill bits be made out of the rock since it was impossible to make the steel sufficiently hard.

Because of the slow progress and high cost, the well drills were abandoned and coyote blasting tunnels, about 4 ft wide by 6 ft high, were tried. Drilling was done chiefly with tungsten-carbide bits, the rock being too hard for ordinary detachable bits. Since that method was started, three large blasts have been made which produced all the rock required at a low cost. The second blast was the largest ever made for construction or commercial purposes. The charge of 526,925 lb of DuPont Nitramon explosive agent, loaded in 2,635 lin ft of tunnel, produced over 800,000 cu yd of loose rock, or more than 1.5 cu yd per lb of explosive.

Combined Spillway and Diversion System

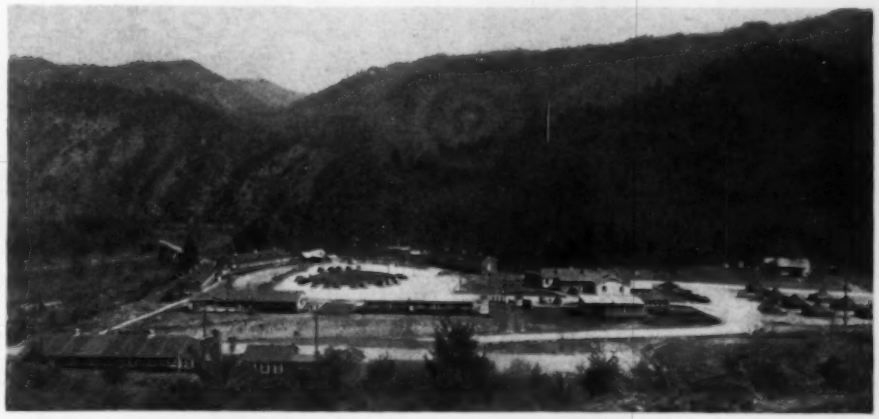
It was logical and economical to combine the tunnel required for river diversion during the construction period and the spillway in one system.

The right bank was the natural site for the tunnel because in that location its length would be relatively short and discharge conditions below the tunnel exit would require little channel improvement.

The spillway [Fig. 2 (*b*)] will have an entrance of the morning-glory type with a crest diameter of 128 ft at El. 1,975. Flow over the crest will be uncontrolled and will enter the vertical leg of the 34-ft-dia concrete-lined tunnel through a funnel which connects it with the horizontal downstream portion of the diversion tunnel. From the spillway crest to the outlet portal, the tunnel is 1,785 ft long with a difference in elevation of 307 ft.

Extensive model tests determined the number and location of the six deflector piers located around the crest. These piers will guide the flow into the entrance and eliminate the surges and pulsations which occurred during high flows over a model spillway built without piers. Desirable flow conditions past the elbow and into the horizontal leg of the tunnel were obtained in model tests by placing a deflector at the point of curvature of the elbow.

The upstream leg of the diversion tunnel will be converted into a sluiceway at the end of the diversion period [Fig. 2(*c*)]. Two 96-in. Howell-Bunger valves will be located in the tunnel plug to control the future low-level discharge. Each valve will have a discharge capacity of about 6,000 cfs under the gross head of 270 ft which will exist with headwater at spillway crest. One 5-ft 8-in. by 10-ft slide gate will be installed upstream from each valve for emergency use. Access to these control features will be through the 280-ft-high concrete tower in which an automatic elevator will be installed.



CONSTRUCTION CAMP with dormitories, mess hall and recreational facilities for 400 men snuggles in rugged mountains of Eastern Tennessee. Watauga River and access road are seen in left background.

Various energy-dissipating structures were studied for use downstream from the Howell-Bunger valves. Without them, model tests indicated the presence of high-velocity flows along the bottom of the sluiceway tunnel which looped completely around the spillway tunnel immediately downstream from their junction. Installation of deflectors at the valves, and a combination weir and guide-vane structure at the junction, considerably improved the flow conditions. The weir insured a greater depth of flow in the sluiceway tunnel thereby reducing the velocity of the discharge from the valves while the guide vanes improved the transitional flow into the main tunnel.

The horizontal portions of the tunnels were excavated by first driving a center 15-ft arched-top pilot heading and then enlarging it to the minimum 37-ft diameter by ring drilling. When the elbow was reached, the pilot shaft was driven around it and upward to the open-cut plaza. The bell-mouth opening and shaft were enlarged from benches, muck being dropped down the pilot shaft and loaded out at the elbow. Extensive timbering was necessary in the tunnel between the wye and outlet portal.

DISPLAY STRESSES COOPERATION between labor and management. Record of number of yards of rock and earth fill placed by first, second and third shifts maintains workers' interest and promotes competitive spirit in production.

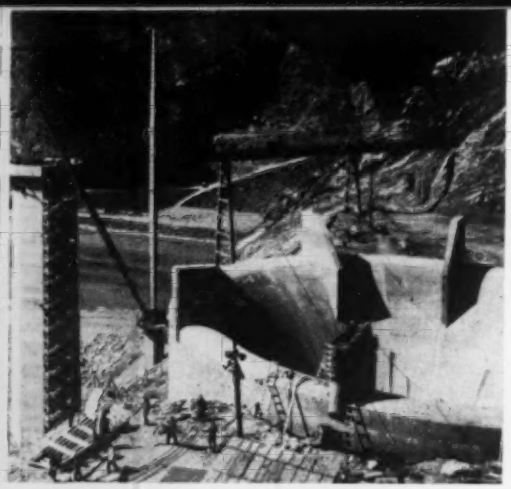
Power Facilities

Several possible powerhouse locations were mentioned in the previous article (CIVIL ENGINEERING, March 1948). The location that was adopted, and at which construction is now proceeding, utilizes an additional fall of about 35 ft which occurs in a distance of 4,800 ft between the dam and the powerhouse site. Most of this fall is concentrated in the ox-bow bend which the Watauga River takes around the ridge known as Cardens Bluff. Movement of the powerhouse to a site further downstream was restricted by the headwater of the TVA's Wilbur project.

The powerhouse, of the indoor type, will be a simple building having space for only the features essential to such a structure. The superstructure will be built of prefabricated insulated aluminum panels erected on a steel framework.

Two 34,500-hp, 200-rpm, 216-ft net-head turbines will be installed. They are being manufactured by the Newport News Shipbuilding and Dry Dock Co. The discharge diameter of the runners will be 105.5 in., while the centerline of the distributor will be set at El. 1,654, or 4 ft above normal tailwater. Specific speed of the turbines at a 216-ft net head will be about 45.

The generators directly connected to the turbines are each rated at



STEEL FOOTBRIDGE provides access to nearly completed sluice control tower. Morning-glory spillway in foreground, with crest at El. 1975, is shown in final stage of construction.

25,000 kw, 0.9 power factor, 60 cycle, and 60 deg C temperature rise. Under favorable conditions of load and with a somewhat greater temperature rise, it will be possible to develop considerable excess capacity for short periods of time. These generators are now being manufactured by the Westinghouse Electric Corporation.

Of special interest is the control building located across the river from the powerhouse. From there, the two generating units at Watauga Dam, the unit at South Holston Dam, now under construction, and a new unit to be installed at Wilbur Dam will be operated by remote control. The Watauga and Wilbur units will be operated by remote control over direct cable between the control building and the plants, while the unit in the South Holston Project, 30 miles distant, will be supervisory controlled by carrier-current over the 66-kv transmission line. There will be no attendants at any of these powerhouses so the normal functions of operation and metering, including those of start and stop, bringing up to speed, and synchronizing with the transmission system, will be performed automatically or by remote or supervisory control. Other operations which lend themselves to automatic action will be so arranged.

The power tunnel, 3,700 ft long, was driven through the same hard quartzite described in a previous paragraph. It will be concrete lined to an 18-ft diameter for approximately 1,240 ft from the upstream end or well beyond a point where possible leakage through the rock strata might cause damage to the dam. An unlined section, 20 ft in diameter, continues for 2,017 ft to the surge chamber where the tunnel drops about 90 ft on a 45-deg angle to a wye and there divides into two 11-ft-dia steel-lined penstock tunnels which continue to the powerhouse [Fig. 2 (*d*)]. Each steel penstock ends at a butterfly valve located at the entrance to the turbine scroll case.

The differential surge chamber was excavated in the hill behind the powerhouse. The chamber, 60 ft in diameter by 235 ft deep, is connected to the tunnel by a 35-ft-long by 18-ft-dia shaft, on top of which the steel riser will be set. The upper 135 ft of the chamber, where the excavation was in bedded shale, was inclined to be leaky and consequently was concrete lined. The quartzite below required no lining.

Excavation of the chamber presented some interesting problems. When the tunnel had been holed through, a 7×14-ft raise was started on the centerline of the chamber. Half of the area was used for a manway, half for a muck chute. A muck-receiving hopper was built in the tunnel below the chute from which the muck cars were loaded. The raise was carried through the quartzite without difficulty except when an open bedding stratum was punctured which carried so much water that it was almost impossible to drill in it and harder yet to keep dynamite in the drill holes. As the raise neared the top, the ground became so bad that several small slides and cave-ins occurred and drilling was too dangerous to continue. Operations were then started on the open-cut plaza, and the top 100 ft of pilot shaft was sunk and timbered from there. The raise was enlarged to full chamber size by drilling and blasting in 10-ft rounds and pushing the muck down the muck chute with a bulldozer which was put into and taken out of the hole with a derrick.

Since the sides of the hole would not stand up, it was necessary to pour the lining in 10-ft bands as soon as the round below had been drilled and shot. The forms were supported on the muck, which was removed after the pour had been made.

(*Continued on page 82*)

Floating Pump Draws Sand from 30-Ft River Pockets

HOME-MADE SAND PLANT, floating on empty 55-gal oil-drum raft (below, left), pumps sand at rate of 58 cu yd per hour from pockets in bed of French Broad River near Biltmore Forest in vicinity of Asheville, N.C. Operated by 100-hp 3-cylinder GM Diesel engine, 6-in. Erie "D" sand pump delivers full load of 130 cu yd in 2¼ hours from depths around 30 ft to bin 50 ft above water level of river (below, right). Sand is allowed to drain before loading by chute into pickup trucks. As each sand pocket is emptied, raft is moved to new location, often requiring 295-ft extension of discharge pipe. Many small sand plants operate productively along banks of French Broad River, supplying substantial amount of material for road construction in region. Plant pictured operates at fuel cost of less than one cent for each 2 cu yd of sand produced.

Welding Permits Use of Lighter Sections in Ore Bridge

USE OF WELDING for the first time on several of its main components distinguishes a 15-ton-capacity ore bridge recently completed for a major steel company by the Dravo Corp. of Pittsburgh. Introduction of low-alloy steel in the trolley resulted in substantial reduction of the dead weight. Except for the main truss and cantilever spans, all parts of the bridge were assembled by welding, giving greater rigidity in the joints.

Of the skew type, the welded ore bridge permits either leg of the bridge, when traveling, to advance beyond the other about $21^1/_2$ ft or until a 5-deg skew is reached. Cantilever spans in the superstructure are $158^1/_2$ and $169^1/_2$ ft long. Each of the two supporting legs has 32 rolled-steel wheels of 27-in. diameter, fully equalized for carrying the 1,250-ton bridge on tracks of 4-ft $8^1/_2$-in. gage. Each set of 16 bridge travel wheels is worm-gear driven by a single 65-hp motor. Bridge travel speed is 100 fpm.

Both legs were shop-assembled to assure proper fit thus avoiding delays in final erection. Shipping units were made as large as possible to minimize field welding. The shear leg, which is the simpler of the two, forms an archway with a supporting bronze bushed ball-and-socket joint over the top center, from which the superstructure is hung. This construction permits the shear leg to lean toward the center span as the bridge skews, during which period the structure is stabilized by the pier leg. The pier leg is a double V-shaped structure made entirely of beams, channels and angles, except for the two box girders of plate construction. Use of welding on this leg permitted great simplification of detail. Erected first, the pier leg required a minimum of falsework. All joints were brought into the same relative position they had during shop assembly so that no vertical adjustment was needed to put the four corners in a plane when top girders were placed.

The 120-ton, all-welded trolley, supported on four 33-in.-dia, spring-mounted wheels, is driven by two 75-hp motors at speeds up to 900 fpm. A good trolley operator can handle 900 tons of ore an hour. Hydraulic buffers were provided at each end of the trolley runway to completely and safely decelerate the loaded trolley from full speed in an emergency. In testing the structure the loaded trolley was run into the buffers at full speed without injuring either the operator or the structure. The main framework of the trolley consists of an $8^1/_2$-ton weldment, $10^3/_4$ ft wide and $33^1/_2$ ft long, made of Mayari-R low-alloy steel. The control house was shop welded into large assemblies. The operator's cab was made as a complete unit with all control equipment.

DOUBLE V-SHAPED PIER LEG rests on trussed sill and carries two box girders at top for sliding support of superstructure. Assembling of legs in shop to assure proper fit saved time in final erection. Large shipping units minimized field welding.

ALL-WELDED STEEL LEGS support riveted main truss and cantilever spans of 15-ton-capacity ore bridge constructed recently by Dravo Corp. of Pittsburgh. Welded trolley, capable of handling 900 tons of ore per hour, is supported on four 33-in.-dia spring-mounted wheels. Bridge travels at speed of 100 fpm.

USE OF NEW METHODS, machines and materials depends on continual improvements in specifications. Pictured here is large variety of modern road building equipment used on Shirley Memorial Highway extension near Alexandria, Va. (Courtesy Public Roads Administration)

Improved Specifications Reduce Highway Costs

DWIGHT W. WINKELMAN

President, The Associated General Contractors of America

ENGINEERS AND CONTRACTORS—the men who design works of construction and the men who build them—have been drawn closer together to resist the common evil of rising prices. Close cooperation of all segments of the far-flung construction industry in finding the best means of giving the public its full value for its investment is imperative. Nonessentials, the fineries for appearances' sake which contribute little to utility, must be found and eliminated. Functional quality and utility must be stressed to stretch the construction dollar as far as it will go. The following remarks concerning the highway field consider the contract and the specifications together. To cover the subject more completely, the matter of design also is considered. This article is based on a paper presented before the Highway Division at the ASCE Pittsburgh Meeting.

CONTRACTORS do not propose to cut down on cost at the expense of quality They do, however, wish to resist any unnecessary added costs, and to eliminate any refinements which do not contribute materially to the functional quality of highways. Specifications should be made the subject of continual scrutiny for any possible improvements that may be necessary to utilize new methods, machines and materials. In general, the manifold items in highway specifications must be considered by the engineers and contractors in the various states who are acquainted with local conditions.

There are, however, certain standards which could be followed nationally in the revision and modernization of specifications:

1. The documents should be definite enough to clearly set forth the details and character of the construction; yet they should be capable of flexibility in interpretation and application in order not to work a hardship on the contractor.
2. They should specify results, not methods. Phrases such as "or as the engineer may direct" should be eliminated wherever possible.
3. All refinements, especially hand labor, which add cost but contribute nothing to the utility of the construction, should be eliminated.
4. Standardization of many materials and some details of design should be effected, particularly in states having similar climatic, geographic, and other conditions.
5. Payments to the contractor should be liberalized so that his capital will not be completely tied up, hampering his operations.

These five points have been agreed upon by highway engineers and highway contractors in meetings of the Joint Cooperative Committee of the American Association of State Highway Officials and The Associated General Contractors of America.

If a contractor is to be held responsible for attaining a specified result, it seems logical that he should be permitted to choose his own methods and equipment.

In the first place, the general contractor proves his skill and ability by his ingenuity in the use of machines and methods. This ability is the stock in trade of each individual contractor, which he pits against that of others in the contracting industry. The principle of competition, which is the major factor in reducing costs in the extremely competitive contracting profession, is limited to the extent that a contractor is required to follow specified methods to attain a specified result.

REDUCED CONSTRUCTION COSTS are possible through cooperation of engineer and contractor in various states in revising and modernizing specifications. Paving operations on four-lane highway in Monroe County, Pa., utilize latest techniques. (Courtesy Public Roads Administration)

ELIMINATION OF OPERATIONS calling for expensive and time-consuming hand labor for unnecessary refinements, and easing of exacting tolerances are steps in reducing highway construction costs. Efficient solution to complicated traffic interchange problem is exemplified by aerial view of Grand Central Parkway and Belt Parkway intersection near Creedmore, Long Island, N.Y.

In the second place, the writer of specifications may not be familiar with the latest methods and equipment used in the field, and consequently may specify a method which would be more expensive than one known to the contractor. There may be a few instances, of course, where it is desirable to specify equipment and methods when they affect the method of payment for the work done, and when the owner assumes responsibility for the result attained. However, competition can be fostered by leaving the engineer, the architect, and the contractor responsible for those functions which rightfully fall in their respective fields.

"As the Engineer May Direct"

A phrase commonly found in highway specifications to which contractors always object is "or as the engineer may direct." This provision obviously could permit unlimited leeway on the part of the engineer in directing the work of the contractor, depending on the discretion of the engineer. While it may not be employed often, such a provision naturally has a disturbing influence on the contractor. If he has had an unfortunate experience as the result of abuse of this provision, it may well influence his future bidding. If the engineer chooses a method of work more expensive than that selected by the contractor, the resulting loss to the contractor may eventually result in greater expense to the owner by additions for contingencies in bids.

At least one state highway department recently took action on this matter. Colorado, in cooperation with AGC highway contractors, recently effected a complete revision of its specifications, with results prescribed instead of methods, and elimination of the phrase, "or as the engineer may direct" among the objectives. An article on the changes made, written by the assistant design engineer of the Colorado Highway Department (*Western Construction News* for September 1947), contained the following statement:

"It developed in the review with the contractors' committee that there is one phrase commonly used by practically all specification writers which should be labeled 'Poison—Use with Caution.' The phrase referred to is 'or as the engineer may direct.' As a usual thing, it was found that where such terminology is required, it can usually be written 'in a manner approved by the engineer' and thus leave to the discretion of the contractor election of the method of proceeding with the work. The good sense of this procedure is self evident. . . ." Other states would do well to follow the lead taken by Colorado.

Unnecessary Refinements

There are some operations, usually calling for expensive and time-consuming hand labor, which could be dispensed with entirely since they contribute little to the efficiency of the project and only add slightly to the appearance of the finished job. In this category are hand rubbing of concrete, fine grading, slope rounding, hand finishing of graded earth roadways, and tolerances too limited to permit use of economical machine work only.

Most requirements for rubbed surface finish of concrete could be eliminated without undue impairment of the appearance, and with no damage to the utility of the finished project. This is particularly true of exposed surfaces which actually are not exposed to the general view of the public, such as box culverts, bridge piers, and bridge abutments.

There are many other refinements not necessary to the utility of a project which have to do with very exacting tolerances. Some states have eased these requirements where such action will not impair the structure or highway. Examples are the tolerances permitted in grade, in horizontal and vertical alignment on secondary roads and in drainage excavation; compaction requirements on secondary roads and in backfills; and maximum depths of embankment on both primary and secondary highways.

Where feasible, particularly on secondary roads, compaction requirements should be reduced to permit deeper "lifts" on fills. A restudy of compaction requirements is advisable for the purpose of permitting greater tolerances in moisture content and in material specifications. Compaction specifications generally are based far too much on theory rather than on actual research. Many of these refinements can be eliminated where contractors will cooperate by doing satisfactory work.

In connection with the subject of tolerances in specifications, it should be stated that one of the most effec-

SPECIFICATIONS is one field which offers opportunities to both the engineer and the contractor to reduce construction costs by their own actions and practices. The keynote in this general field was sounded last year in a paper presented to the ASCE Construction Division by the late Charles F. Lovan and George B. Hills, Members ASCE, who pointed to the possibilities of achieving lower costs through clear, precise specifications and contracts (CIVIL ENGINEERING, Nov. 1947).

INCREASED MECHANIZATION—effective means of reducing highway construction costs—requires continual modernizing of specifications. In photo (above, left) road gravel obtained from creek bed is stockpiled by D7 tractor equipped with Caterpillar cable-control bulldozer. Material is loaded into truck by Athey Mobiloader. Three Caterpillar D8 tractors with Le Tourneau scrapers and two D8 pushers (above, right) are employed on section of Highway 99 relocation near Bloomington, Calif.

tive means of reducing costs in highway construction is through increased mechanization, which is particularly adaptable to this type of work. New machines are being produced or planned which have increased efficiency. Tolerances must be eased in many sets of specifications to permit the widest possible utilization of these machines. When it is known that such tolerances are being permitted, equipment manufacturers will be encouraged to continue improvements and research, and contractors will find it necessary to become more and more mechanized in order to remain on a competitive basis.

In working with the AASHO, many members of the AGC have been emphasizing the desirability of modernizing specifications to permit more mechanized operations. To fully utilize the advantages of mechanization requires the permission of greater tolerances in many items, thereby eliminating the extra cost of hand labor not absolutely essential to the utility of the project. Examples are:

1. Elimination of hand trimming of ditches and slopes to permit finishing by machinery. Only such regular and uniform finish of surface, inslopes, ditches and backslopes as may be obtained by efficient mechanical methods should be required.

2. Development of tolerances that will permit maximum mechanization in grading, paving, and compaction.

Consideration should also be given to permitting more latitude in the substitution of welded construction in many parts of bridges and other structures in place of the more expensive method of riveting.

The maxim, "specify results, not methods," is a good one since it leaves the contractor free to develop new methods to accomplish the desired result most efficiently. With the increased use of new and improved machinery, many economical methods can and will be developed by contractors.

Standardization of Specifications

At a recent meeting of the Joint Cooperative Committee of the AASHO and the AGC, highway engineers and contractors agreed that the various states are developing too many different types of specifications. Standardization in this field requires some pioneering but offers many opportunities to cut costs. All highway engineers and contractors should be interested in promoting standardization wherever possible.

Standardization of specific materials is needed as well as standardization of specifications in neighboring states in regions having similar climatic, geographic, and other conditions. Among the specific items that could be standardized to afford greater efficiency and economy are:

1. Wire mesh. It has been reported that 23 different types of wire mesh have been specified by the various highway departments throughout the country.

2. Culverts, bridges and other structures. Standardization in this category would save substantial time and expense by permitting reuse of forms from job to job.

3. Curbing, handrails and guard rails.

4. Terminology of specifications; requirements and basic sizes and weights, compatible with regional conditions.

Little progress has been reported in standardization. However, a movement is reportedly under way in the Northwest to bring about uniformity of requirements in states having similar conditions and problems. The importance of this subject may make it advisable to propose a study by an unbiased body such as the Highway Research Board to recommend standardization of as many items as possible to obtain good results with greater economy.

Payments to the Contractor

Another important item that deserves more attention is the frequency and amount of payments to the contractor. Late or deferred payments may hamper him in his operations by tying up his capital. This difficulty has been more evident in other types of public construction, but some complaints have been heard in the highway field. The revised Colorado specifications previously mentioned incorporate revisions upward in payments to contractors.

Other improvements which engineers could apply locally in the administration of their highway program are the following:

1. Projects should be advertised 30 days preceding the opening of bids, even though less time may be provided for by statute in some states. This affords contractors in the area more time to prepare intelligent bids and to schedule operations.

2. Jobs should be awarded in an orderly manner, rather than in bunches, so as to utilize the full capacity of contractor organizations and invite more bids.

3. Under present conditions, as far as possible, bids should be awarded only on those jobs that can be completed in one season.

Design Engineers and Contractors

The subject of cost-saving factors in specifications leads inevitably to that of the major influence of design. It is essential that design engineers in highway departments be familiar with the possibilities of mechanized operations, of the use of less expensive materials or of materials that can be obtained locally, and of eliminating costly non-essentials.

erhaps the best method of making ich possibilities known to the de- rn engineer is to arrange for him to sit the actual sites of operations for period long enough to acquaint him- lf thoroughly with job practices d problems.

In a number of fields closer co- peration between engineers and con- actors can benefit the public by rmitting more efficient and eco- mical construction. Engineers and ntractors are partners in a team, nd they should further cooperative elations in an atmosphere of mutual espect, understanding and con- idence. Serious consideration should e given to the appointment of a tanding committee of engineers and ontractors to carry out such co- peration on an organized but in- formal basis. Liaison between design engineers and general contractors is more important today than ever before.

Five general principles have been suggested herein for revising the specifications of state highway de- partments. The real work of such revision must of course be done locally by those who know best how to cope with the particular conditions involved. Recent experience in this field has shown that the most satis- factory results are obtained when the highway department collaborates with the contractors in arriving at specifi- cation changes, seeking additional advice from material and equipment producers when necessary.

Encouraging developments in the modernization of specifications have already occurred in some states and are under way in others. In most instances this is the result of ground- work laid over a period of many years by the Joint Cooperative Com- mittee of the AASHO and the AGC, which has served as the vehicle for highway engineers and highway con- tractors to get together and work out their mutual problems. Several joint committees have been or are being set up on a state or regional level, patterned after this committee, to offer local means of meeting such problems. The establishment of such committees throughout the states offers the best shortcut for the solu- tion of highway construction problems by engineers and contractors.

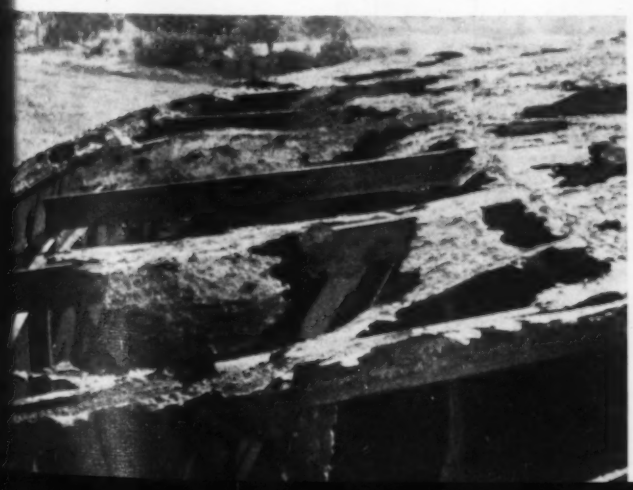
Close local cooperation of this sort should serve to keep specifications up to date, and to prevent their riding along for years until they become hopelessly outmoded. Specifications should be examined carefully at frequent intervals by engineers, con- tractors, materials producers, and equipment manufacturers, with the common objective of making pos- sible the utilization of some new method, new material, or new ma- chine that may help to build more economical highways.

FINISHING BY MACHINERY of ditches and slopes, eliminating expensive hand labor operations, is possible if less rigid tolerances are specified. Here Lorain Shovel handles rock on difficult section of new road near Glacier National Park in northwestern Montana.

Mineral-Wool Cement-Base Roofs Meet Rigid Requirements

ATTACKED ON INSIDE by hydrogen sulfide fumes combined with moist air, metal-plate tank roofs last only from six to eight years in tropical Gulf Coast area. When confronted with problem of re- pairing not less than 50 of its 55,000-bbl tanks, Petroleos Mexicanos experimented for over a year with different types of roofing materials. Roofing had to be (1) rugged enough to support workmen, (2) no heavier than $^3/_8$-in. steel plate, and (3) elastic enough to withstand excessive expansion and contraction caused by tropical sun and frequent showers.

MOST ECONOMICAL ROOFING developed has mineral wool cement base. It is poured in place to 2-in. thickness. Reinforcing shown is 12-gage wire mesh. Finished roof has sufficient beam- strength to support any normal weight or shock, is light in weight, waterproof and lightning-proof. New roof can be expected to out- live metal by at least four times and costs no more. Major advantage stems from insulating qualities which insure more uniform tempera- ture inside tank and thus reduce to minimum, losses by evaporation and breathing of more volatile fractions of crude oil.



Pure Oxygen in Bio-Precipitation Process May Reduce Sewage Treatment Costs

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RESULTS OF RECENT EXPERIMENTS in the treatment of sewage, in which pure oxygen is utilized in an upward-flow bio-precipitation process, indicate the possibilities of increased plant capacities and greater degrees of purification than are now obtainable through use of the activated sludge process. Still in the experimental stage, the new process gives sufficient evidence of large savings in sewage purification costs to warrant the construction of a pilot plant to obtain more precise operational data. This article describes the experimental work conducted at Harvard University by the author on the basis of suggestions outlined by Malcolm Pirnie, Past-President, ASCE, for taking advantage of the reduced cost of commercially produced oxygen in improving sewage purification methods.

IF THE SCIENCE of sewage purification had not advanced in the last 60 years, the city of Chicago would today require an area of about 20 sq miles for the treatment of its sewage by sand filtration. This is an area about three times as large as that of the city of Cambridge, Mass.

The trickling filter, developed at the turn of the century, reduced area requirements considerably. This process consists essentially of passing the sewage over a bed of broken stone. The organic matter in the sewage is transferred to the biological growths, rich in bacteria and other microorganisms, which form on these stones. The organisms take nutriment from this organic matter, utilizing it for energy and for further growth of the biological masses, while the stable end-products are carried away in the treated sewage. A trickling filter plant for Chicago would require about 1 sq mile of area, more than twice the space occupied by the Harvard community, including Radcliffe.

Research work begun at the Lawrence Experiment Station in Massachusetts in 1912 led eventually to the development of what is now the most efficient method for the high-degree purification of sewage, namely, the activated sludge process. In its principle of operation it differs little from the trickling filter. The biological growths, instead of being attached to the surface of stones, are freely suspended in the sewage. The necessary oxygen, instead of reaching the growths through the void spaces between the stones, is introduced by aeration, generally by bubbling compressed air through the mixture of growths (known as activated sludge) and sewage.

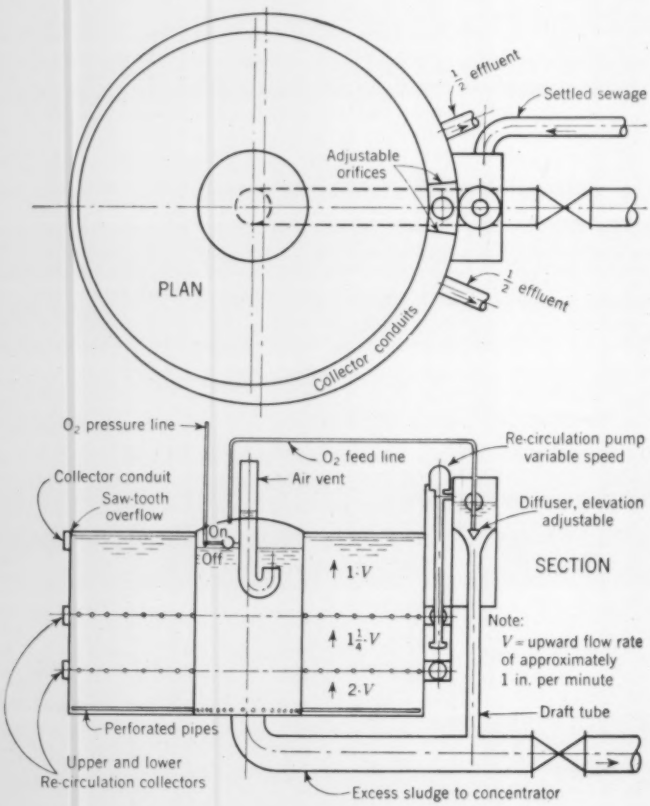


FIG. 1. PLANT DESIGN utilizes pure oxygen in treating sewage. Settled sewage enters at right, is oxygenated in down-draft tube and discharged through openings in system of radial pipes. Sewage flows upward through suspended flocculent mass of microorganisms onto which polluting material in sewage is precipitated. Treated sewage passes over effluent weir.

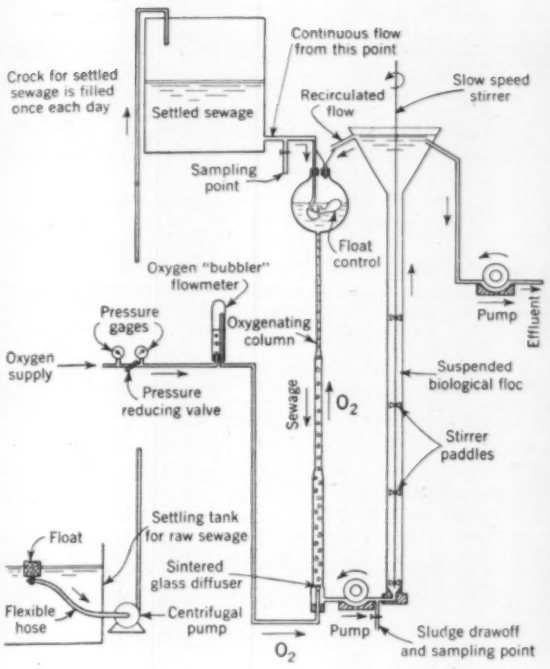
In a typical activated sludge plant, the heavier particulate solids are allowed to settle out in the primary tank. The sewage is then mixed with the activated sludge and aerated vigorously in the aeration tank. After about 6 hours of aeration, the sludge, with its adsorbed organic matter, is settled in the final sedimentation tanks. The activated sludge, except for that formed in excess of requirements, is returned to the aeration-tank influent. The final treated sewage flows over effluent weirs into the receiving water.

It should be noted that the air in the activated sludge process serves two purposes: (1) It supplies the oxygen requirements of the sludge, and (2) it keeps the activated sludge in suspension. It should also be noted that in the final tanks the organisms in the activated sludge are deprived of oxygen, although the organisms will be called upon to remove the polluting matter from the next batch of influent sewage.

During the last decade, emphasis in the field has been devoted to attempts to reduce the required plant capacity by increasing the loading. Various types of high-rate plants have been built, but operation of these has in general been accompanied by a lower degree of purification.

Development of Bio-Precipitation Process

In October 1946, Malcolm Pirnie, Past-President ASCE, sent Dean Gordon M. Fair, M. ASCE, of Harvard, a memorandum entitled "Cheap Oxygen Possible New Tool in Sanitary Engineering." Attached to the memorandum was the proposed plant design utilizing pure oxygen shown in Fig. 1. All the oxygen required by the process is carried in by the pre-oxygenated sewage. Whereas sewage saturated with air contains only about 9 ppm of dissolved oxygen, sewage saturated with oxygen will contain 45 ppm. The hydrostatic pressure at the bottom of the column will further increase the oxygen saturation value.



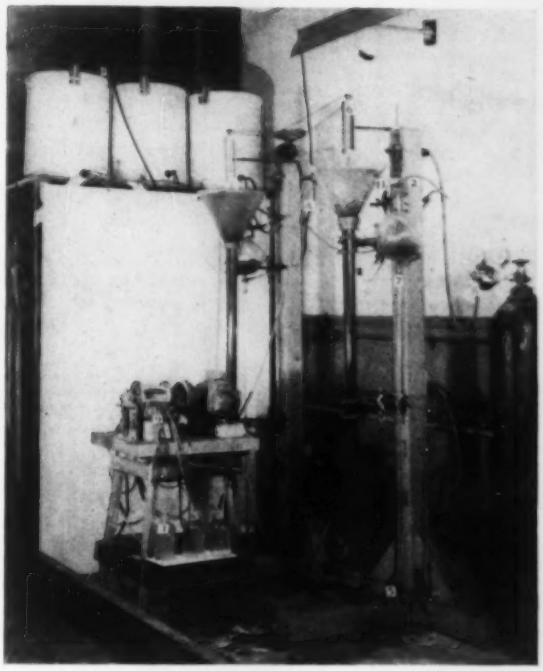


FIG. 2. SCHEMATIC DIAGRAM and photograph of apparatus show laboratory set-up for experiments in purification of sewage by bio-precipitation process on continuous-flow basis. By operating two such plants in parallel on same sewage, it is possible to study effect of factors influencing operation of process.

The oxygen requirements of the process are dependent upon several factors, including the strength of the sewage. If the oxygen requirements of the process are higher than the oxygen content of the incoming preoxygenated sewage, some of the effluent is recirculated.

Laboratory work was begun in March 1947. Preliminary experiments revealed that high oxygen concentrations were not deleterious to the activated sludge process, but actually appeared to be more efficacious than the low oxygen concentrations associated with the use of air. In conformity with the flow pattern suggested by Mr. Pirnie, a laboratory apparatus was designed and constructed, at the Harvard Graduate School of Engineering, for the purification of sewage on a continuous-flow basis. A schematic diagram and photograph of the apparatus as it was finally developed appear in Fig. 2.

Operation of Laboratory Plant

In the laboratory procedure, sewage is pumped from a street sewer adjacent to the laboratory into a tank in the basement, where it is allowed to settle. The settled sewage is pumped into crocks from which it is fed continuously to the plant. The sewage flows into the reservoir, where the level is maintained constant by float control. The sewage then flows down the oxygenating tube, where the oxygen bubbles, fed through a sintered glass diffuser, move counter-current to the sewage. The sewage is then pumped into the bottom of the precipitation tube, which contains the suspended biological floc. The effluent is collected from the top of the apparatus. Effluent is recirculated to provide sufficient oxygen for the process. The recirculated flow is taken from the top for ease of control, although it could be taken at a lower level, reducing the overflow rate. A slow-speed stirrer was found necessary to keep the suspended material from coalescing into large masses and to prevent short-circuiting.

The bio-precipitation process overcomes some of the disadvantages of the activated sludge process by embodying three new ideas:

1. Oxygen requirements are satisfied at all points in the flow by preoxygenating the sewage to be treated.
2. Use of pure oxygen promotes efficient gas transfer, and the high oxygen gradient enables the oxygen to penetrate more deeply into the floc particles.
3. Separate final sedimentation facilities are not required. The biological media are not permitted to suffer the hazard of anaerobiasis (insufficiency of oxygen) ordinarily associated with sedimentation in final tanks.

Because of this more "sympathetic" treatment of the biological floc, and because more of it can be maintained in a given space than in the activated sludge process, it is reasonable to expect better purification per unit of tank volume with the bio-precipitation process. That this is the case is seen in the graph, Fig. 3.

The percentage removal of B.O.D. is shown on the ordinate. The loading of the plant is shown on the abscissa. In comparison with the curve suggested by Samuel A. Greeley in 1943 ("High-Rate Biological Sewage Treatment," *Sewage Works Journal*, Vol. 15, 1943, page 1062) for the purifications obtained with different loadings in high-rate activated sludge plants, the results obtained in the bio-precipitation experiments show that for equal loadings the efficiency of this process is considerably greater. To achieve 90-percent purification, the bio-precipitation process can be loaded about four times more heavily than the conventional ac-

(*Continued on page 84*)

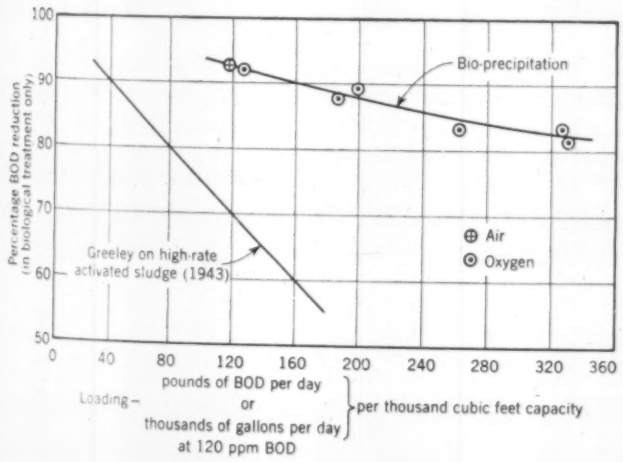
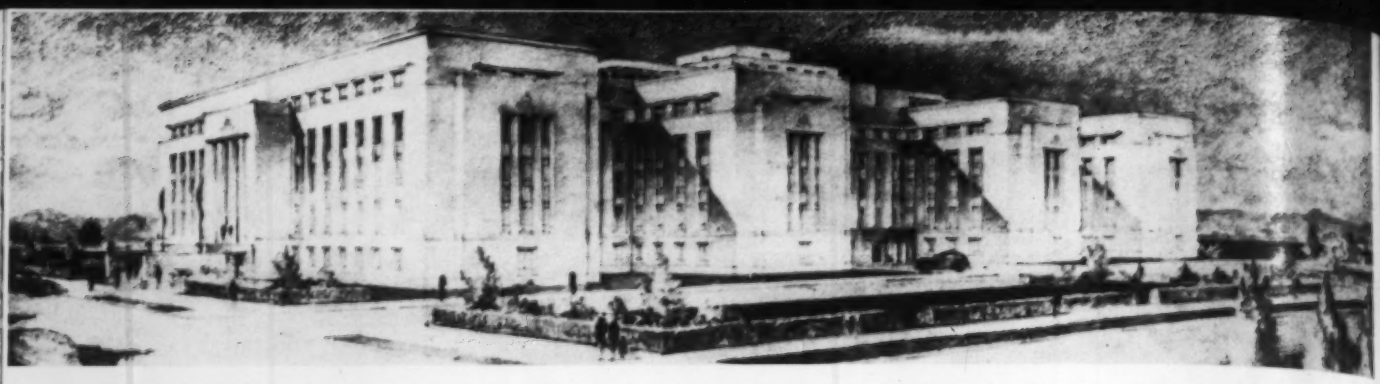


FIG. 3. BETTER PURIFICATION per unit tank volume with bio-precipitation process is indicated by curves which show relation between loading and B.O.D. reduction in biological sewage treatment.



AIR-RAID PRECAUTIONS are featured in design of reinforced concrete Administrative Offices Building, latest addition to Australia's capital city of Canberra. Besides special reinforcement throughout building, first floor is designed for debris load of 200 lb per sq ft in addition to design live load of 110 lb per sq ft assumed for all floors of structure.

Australia Follows Master Plan in Developing Federal Capital at Canberra

Work on Capital City Is Resumed With Construction of New Administrative Building Designed in Keeping With Modern Air-Raid Precautions

GEORGE S. BORIS

Civil Engineer, Federal Department of Works and Housing, Canberra, Australia

CANBERRA, capital of Australia, is a half-grown city of embassies, legations, administrative buildings and wide open spaces. The capital is situated in a federal territory of 572,681 acres, almost on a direct line between Sydney and Melbourne, near the southeast tip of the continent. This site was chosen in 1911 to resolve the concurrent demands of Sydney and Melbourne—capitals of the two most populous states of the commonwealth—to be made the permanent seat of the Australian government. Parliament has met there since 1927 but more office space is needed so that additional federal departments can be moved to the capital. To help meet this need the Administrative Offices Building described in this article is now under construction. With its 250,000 sq ft of office space, the new reinforced concrete building, estimated to cost 6 million dollars, is expected to accommodate about 3,000 officers of government departments and their staffs.

FIRST STEP in the postwar program for making Canberra the esthetic and cultural as well as the political capital of Australia is the construction of a block of administrative offices, a reinforced concrete structure embodying special design precautions against air raids. This building has been planned and located in accordance with the long-range program for the city.

In the competition for the design of the city in 1913, a total of 137 entries from all parts of the world were considered and judged by the Federal Capital Design Board consisting of one engineer, one architect and one surveyor. The winner was a young American architect, Walter Burley Griffin of Chicago, Ill., who later went to Canberra to supervise construction. He died in 1937, leaving his plans to be executed by the Federal Department of Works and Housing. The outstanding feature of Mr. Griffin's plan is a series of broad boulevards encircling the main sections of the city area, each section to be occupied by a major structure.

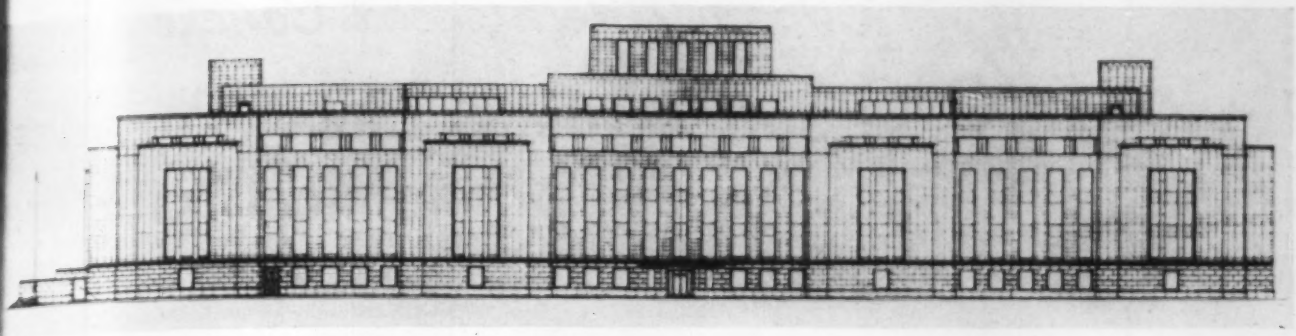
Geologic and topographic conditions are favorable for a modern city such as that planned for Canberra. The site, in an amphitheater of hills at an elevation of 1,900 ft, is imposing, and the location is such that the city is visible from a distance of many miles. The foundation rock consists of standstone, quartzite, shale, slate, limestone and volcanic tuff, which without exception are suitable for the construction of heavy buildings. An adequate water supply is provided by the Cotter River catchment basin, which covers the western part of the territory.

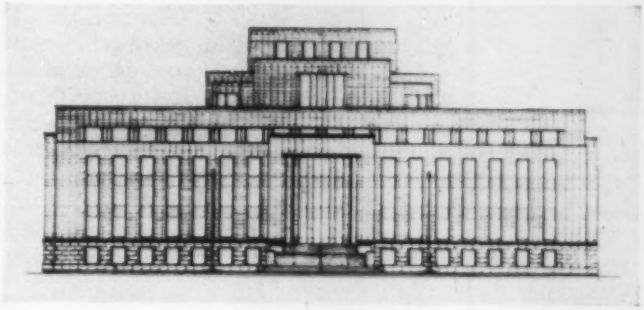
Canberra has direct air-route connections with all state capitals of Australia, and adequate transportation facilities are provided by a railroad connecting it with both Sydney and Melbourne. If direct access to the ocean is desired, there is a feasible route for a railroad from the city to Jarvis Bay, a distance of 123 miles.

All these advantages, plus an agreeable climate, have contributed to the

TABLE I. GRADING OF AGGREGATE, USING ANGULAR COARSE AGGREGATE

Class of Concrete	Percentage, by Weight, of Aggregate Passing									
	1½ In.	1 In.	¾ In.	⅜ In.	⅜ In.	7	14	25	52	100
A	...	90–100	76–94	51–63	33–41	21–25	12–14	5–7	0–2	...
B	...	90–100	77–95	52–64	35–43	23–29	14–18	8–10	3–5	0–2
C	...	90–100	77–95	54–66	37–45	25–31	18–22	11–13	6–8	3–5
C1	90–100	...	63–77	44–54	31–37	21–25	14–18	9–11	5–7	3–5





SIX-MILLION-DOLLAR Administrative Offices Building, started this spring, is scheduled for completion in four years. Structure containing 24,000 cu yd of concrete and 2,400 tons of steel will permit transfer of additional federal departments to Australia's new capital city of Canberra. Southwest elevation (above) shows 447-ft side of building, which has two basement floors plus eight above street level. Main entrance dominates northwest elevation (right).

growth of the capital. The population of the territory, which was 1,700 in 1911 when the federal government took possession, had grown to 16,000 in 1947.

Design of Administrative Offices Building

The site of the new building is in the district of parks, the section known as "Government Group," 200 yd from the Parliament House and $1^3/_4$ miles from the railway station. The plan of the structure is in the form of a connected double "H" (H–H), 224×447 ft in plan and 119 ft high. There are ten floors, eight of them above the street level.

Offices occupy six floors, one of them below the street level. The seventh floor is for a cafeteria and the eighth accommodates a recreation room, motor rooms, and small water storage tanks. The main water storage tank is to be on the ninth floor. The subbasement floor will have parking space for cars and bicycles and will also house an electric substation, battery and power rooms, mechanical ventilating plant postmaster general equipment and manual switch, emergency generating plant and a first-aid station.

Exterior walls below the elevated ground floor will be of selected red Australian granite and above this floor the walls will be faced and finished with Australian gray sandstone. Walls of vestibules, corridors and sections of stairways will be marble lined.

Provisions of the Air Raid Precautions Act, incorporated in the design of the new structure, are as follows:

1. The beam-and-girder floor system has reinforcement in the top and bottom for slabs, beams and girders. The minimum thickness of slabs is 6 in.

2. The ground floor only is designed for the effect of the debris load (assumed to be a static load of 200 lb per sq ft) in addition to the design

(*Continued on page 82*)

CONSTRUCTION OF AUSTRALIA'S new capital of Canberra has been divided into three stages to avoid too large an expenditure at one time, as follows:

FIRST STAGE was the establishment of parliament at the capital, attended by such administrative departments as were more closely associated with the central government. This stage was effected in 1927, when the national parliament met in the city for the first time.

SECOND STAGE is the removal of the central administration of other departments to the seat of the government and the execution of some permanent architectural and engineering works and additional railway connections. This stage of development is now in progress. A 50-million-dollar building program for the next seven years was announced in March 1947 by Australia's prime minister, Mr. J. B. Chiefley. The main features of the program are:

1. New Administrative Offices Building, 6 million dollars.
2. National University Buildings, 4 million dollars.
3. Eighteen hundred houses, 10 million dollars.

THIRD STAGE is expected to extend over a prolonged period, sufficient to provide for the progressive realization of permanent and monumental works—art gallery, museum, libraries, memorials, schools, and theaters.

TABLE II. PROPORTIONING OF CEMENT AND WATER FOR FOUR CLASSES OF CONCRETE

Class of Concrete	Max. Size of Aggregate In.	Required Compressive Strength at 7 days	Required Compressive Strength at 28 days	94-Lb Bags of Cement per Cu Yd of Concrete	Max. Water per 94-Lb of Cement, Gal*	Slump Range, In.	Fine Agg. % Total Agg.	Approx. Weights of Surface-Dry Aggregates per Bag of Cement, in Lb† Total	Fine Agg.	Coarse Agg.
A	1	2,900	4,200	8	4.2	1–3	33–41	362	134	228
B	1	2,500	3,600	7	4.8	1–3	35–43	426	166	260
C	1	2,100	3,000	6	5.4	1–3	37–45	510	209	301
C1	$1^1/_2$	3,000	3,000	5.5	5.4	1–3	31–37	575	196	379

* Surface (free) water contained in the aggregates shall be included in the quantity of water required per 94-lb bag of cement.
† The weights given in the last three columns are approximate only, being based on normal aggregates having a specific gravity of 2.65, and are included for the guidance of the contractor only.

Precast Reinforced Concrete

Sewer Tunnel Lining Provides Sound, Economical Structure

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(Formerly Consulting Engineer, Tel-Aviv)

THAT DESIGN AND CONSTRUCTION techniques are influenced by the particular conditions encountered in various parts of the world, is borne out in this description of the unconventional features incorporated in a reinforced concrete sewer tunnel and sea outfall constructed under adverse conditions in Tel-Aviv, Palestine. Lack of steel, timber and proper construction equipment, plus difficult soil conditions and other limiting factors, called for ingenuity which may find application on similar projects constructed under more favorable conditions.

TUNNEL FROM SHAFT near mid-point of structure is shown in view above. Eight-inch-thick reinforced concrete wall of 13×23-ft main shaft, sunk to depth of 30 ft below ground level, was broken by driving (horizontally) 7-ft-long light steel sheetpiles, under protection of which roof-shield was mounted and first two rings erected. Space between sheetpiles and precast rings is filled with concrete.

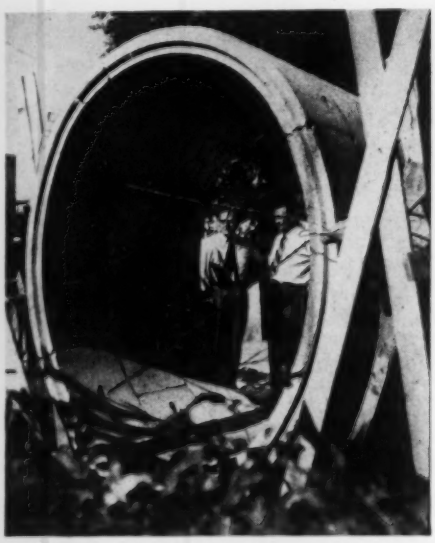
IN 1946 the municipality of Tel-Aviv, Palestine, called for bids on the construction of the main part of the town sewer, consisting of a 600-ft-long temporary outfall into the Mediterranean at sea level, a 2,300-ft-long tunnel crossing a consolidated dune adjoining the shore at a maximum depth of 60 ft below the surface, and a considerable length of large-diameter sewer pipe in open cut. The contractor was free to accept the design of the municipality or to base his bid on his own design.

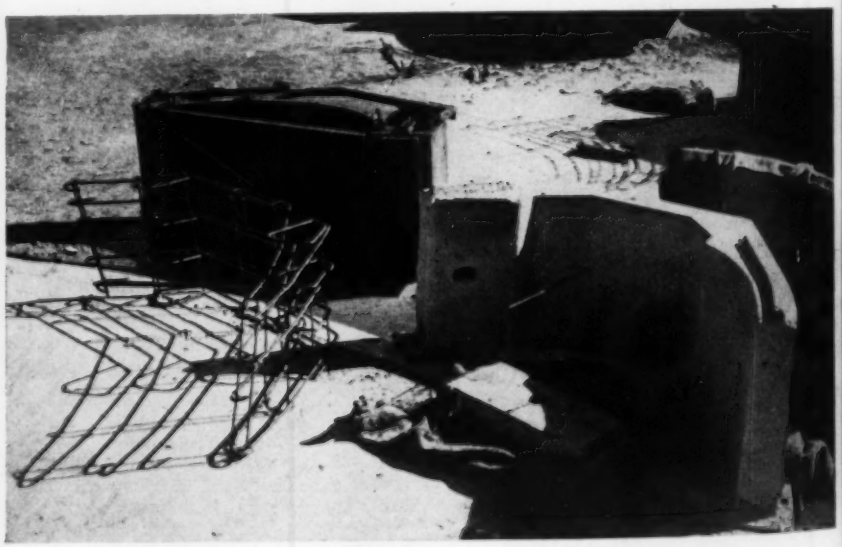
The contract was awarded on the basis of an alternate design prepared by the writer. This design, incorporating extensive use of precast reinforced concrete, resulted in a bid substantially below the estimate of the municipality. The economy was achieved primarily in the tunnel lining and in the sea outfall. The latter was redesigned to utilize precast construction. The design contains some unconventional features which, although resulting from economic conditions peculiar to Palestine, may be of wider applicability.

The economic conditions referred to are:

1. Total lack or extremely high cost of steel, particularly sheet, and also of structural timber.
2. Limitations on the importation of construction equipment and machinery caused by exchange restrictions.
3. Relatively small volume of heavy construction work, justifying reluctance on the part of contractors to overinvest in equipment.

These conditions made any conventional approach to design and construction, such as the use of steel liner plates or timbering in the tun-





THREE RINGS OF PRECAST TUNNEL LINING (above, left) are erected above ground to test fit of joints. View shows four segments and keystone forming ring, and circumferential tongue-and-groove joint which provides ring interaction. Cross wires in test section substitute for earth pressure to prevent accidents. View (above, right) shows bottom segment of reinforced concrete tunnel lining, steel mold and reinforcement. Key segment is seen in foreground. Shallow U-shaped cut in bottom segment is filled by concrete cast in situ after erection of rings and placing of longitudinal reinforcement over length of at least 20 to 30 rings.

nel, or of steel or timbering in the sea outfall, prohibitive.

Wide Variations in Soil Conditions

Borings to the proposed depth of the tunnel disclosed a considerable variation in soil conditions over comparatively short distances. Relatively hard layers of sand-limestone agglomerate alternate with layers of fine sand, of raveling reddish-brown sandy loam and of moist dark-brown clay. No water above the tunnel invert was encountered in the bore holes.

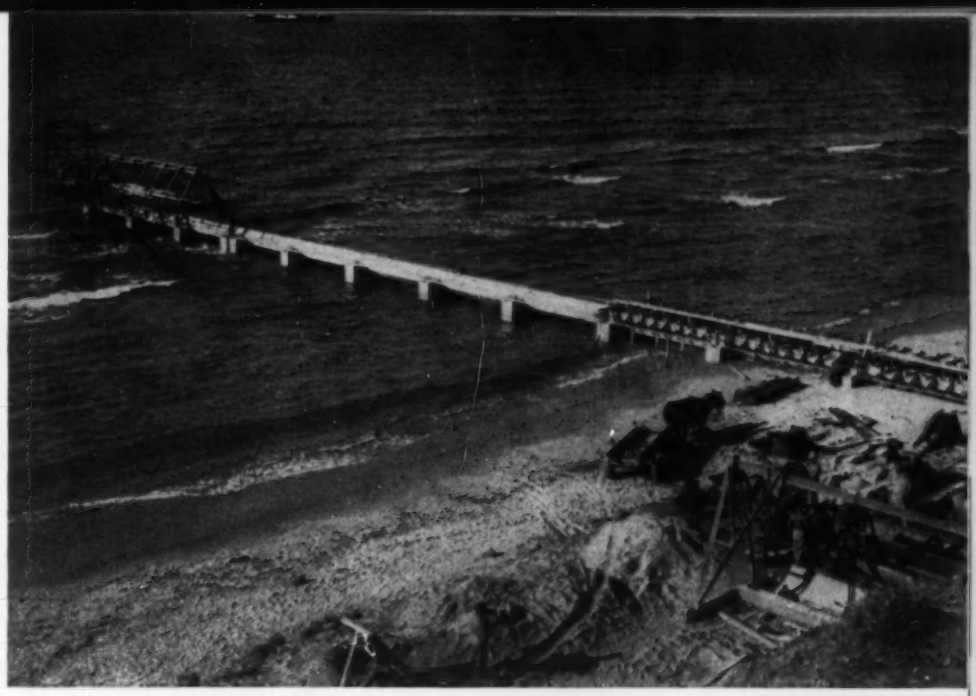
To provide minimum working space underground, the dimensions selected for the elliptical tunnel section were 80 in. high by 60 in. wide, as compared with 66 in. high by 36 in. wide, the dimensions of the egg-shaped section called for by the municipality. The elliptical shape was chosen because it proved to be the most effective in meeting the varying pressure conditions resulting from the variations in the soil, the bending moments carried by the lining being relatively small.

The tunnel lining consists of reinforced concrete rings each 20 in. wide and 5 in. thick. Each ring is built up from four precast segments and a small key block. The bottom section is shaped so as to provide space for the casting in place of a wide, flat, reinforced beam, connecting the rings longitudinally.

The lining is designed as a flexible ring, and the pressure distribution around it is considered as a function of the elastic-ring deformation. The continuity of the deformation is safeguarded by the arrangement of the tongue-and-groove joints between the rings, and by the staggering of the joints between the segments. Thus each pair of rings is considered to resist jointly the forces and bending moments computed for a width of 40 in., the width of two adjacent rings. Actually at joints the moment is carried by the 20-in.-wide section of one ring only, while the axial pressure is resisted by the full width of both rings.

To strengthen the precast lining and integrate it with the surrounding soil, a layer of grout is placed behind it through grout holes in the segments. After completion of the tunnel, an inner layer of "guncrete," $^1/_2$ to 1 in. thick, is provided to ensure the required smoothness.

Each segment is reinforced along both the internal and external perimeters by $^3/_8$-in.-dia prestressed round bars. The computed compression stresses in the concrete, under the most unfavorable pressure distribution to be expected around the lining, do not exceed 700 psi. Under these conditions stresses in the reinforcing steel attain 16,000 psi. The selection of prestressed reinforcing steel with a designated yield strength of some 50,000 psi would thus not be justified by the stress level. However, it was considered desirable to eliminate the danger of wide cracks opening in the tunnel lining under an extreme, although improbable, local pressure causing stresses in the reinforcement exceeding the yield strength of normal-grade reinforcing steel. The concrete of the segments, containing about 400 lb of cement per cu yd, was placed in the steel molds by needle vibrators working in the space between the two layers of reinforcement. The side walls of the molds were removed a few hours after casting, and within 24 hours the hardened segments were removed from the steel bottom plate which molded the groove. The precast segments were then cured for 7 days, stored and used at an age of not less than 21 days.



AUXILIARY STEEL CANTILEVER is advanced into position for driving piles of next support for sea outfall which is about one-third complete. Timber molds have been placed along first three spans for casting longitudinal beams connecting precast sections. Because of considerable difference in rigidity—both laterally and longitudinally—of supports in shallow water near shore line and deeper water, an expansion joint with double supports is provided. Semicircular section is being cast in foreground.

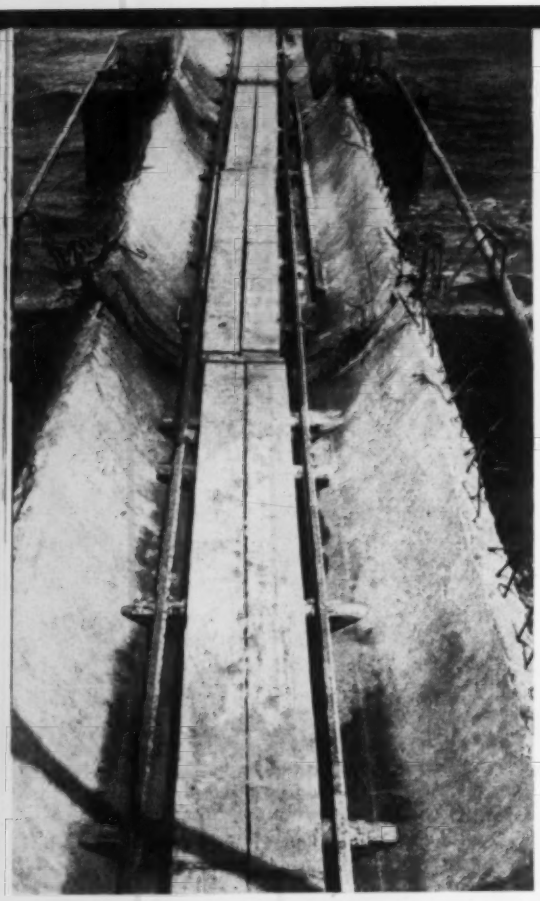
LIGHT ROOF-SHIELDS advancing from sea entrance and from shaft meet in "hard" ground. Bolt-connected steel segments forming roof shield and light jack screws for driving shield forward can be seen.

Tunnel Driving Procedure

In selecting a driving method for the tunnel, the following facts had to be considered:

1. More than two-thirds of the tunnel length was to be driven through raveling ground, which made excavation without roof support impossible.
2. Timbering or the use of lost liner-plates was economically impracticable.
3. For more than half of its length, the tunnel was to be driven with its roof 14 to 18 ft under a narrow city road lined by buildings with shallow foundations.
4. Because of restricted space, only two men could work at the front.

Under the tunnel driving method adopted, excavation and erection of the rings proceeded under the protection of light, $6^1/_2$- to 10-ft-long, roof-shields constructed of 20-in.-wide, welded-steel liner-segments connected by bolts and provided with



HALF-CIRCULAR PRECAST SECTIONS are shown in position on supports. In background full section has been completed by casting longitudinal beams, reinforcement of which—together with reinforcement of crossbeams and protruding tangential reinforcement of precast sections—ensures longitudinal rigid-frame action of structure.

a cutting edge in front. The liner segments were so light that they could be easily handled by one man. In ground which had a very short standing time the upper section was excavated around the perimeter a few inches in advance and the roof shield shoved forward by screw jacks pressing against the completed concrete lining, until a forward support of about 20-in. depth was created. The back support was provided by trench-jacks pressing against the last-placed bottom segment. Between these two points the roof-shield was self-supporting, cantilevering backward to provide the necessary protection for the erection of one ring.

This method of tunnel driving was satisfactory as long as the ground was dry enough to be relied upon for support. Where water seeped through from high-level rain-water accumulations and from percolation pits, raveling ground deteriorated rapidly and some difficulty was encountered in preventing the back support of the shield from sagging. In relatively hard ground, which, however, was often not entirely reliable because of its high content of fine sand, a length of 20 in. was excavated in advance, and the roof-shield was shoved forward by pully.

The tunnel was started from both ends and from a pit near its midpoint. After initial difficulties were overcome and workers who had never before worked below ground had acquired some skill, the rate of advance reached 6 ft 8 in. (four rings) per working day on each front.

Sea Outfall Designed as Jetty

From the tunnel exit a sea outfall carries the sewage about 600 ft out to sea; this length will later be extended. The outfall was designed as a jetty with supports and spans of reinforced concrete. Supports are spaced at intervals of 20 ft. Each support is made up of two piles 6½ ft apart, driven to a depth of 15 to 20 ft into the sandy sea bottom. Piles consist of light steel pipe, 16 in. in dia and ⅛ in. in wall thickness, filled with concrete and reinforced so as to be able to carry all loads and moments without the aid of the steel pile shell. The two piles in each support are rigidly connected by a heavy reinforced concrete crossbeam cast in place in a steel mold.

The supports carry precast concrete spans of semicircular cross section, 6 in. thick, which are reinforced longitudinally by steel bars placed at the center. Lighter reinforcing steel is placed at right angles to these steel bars.

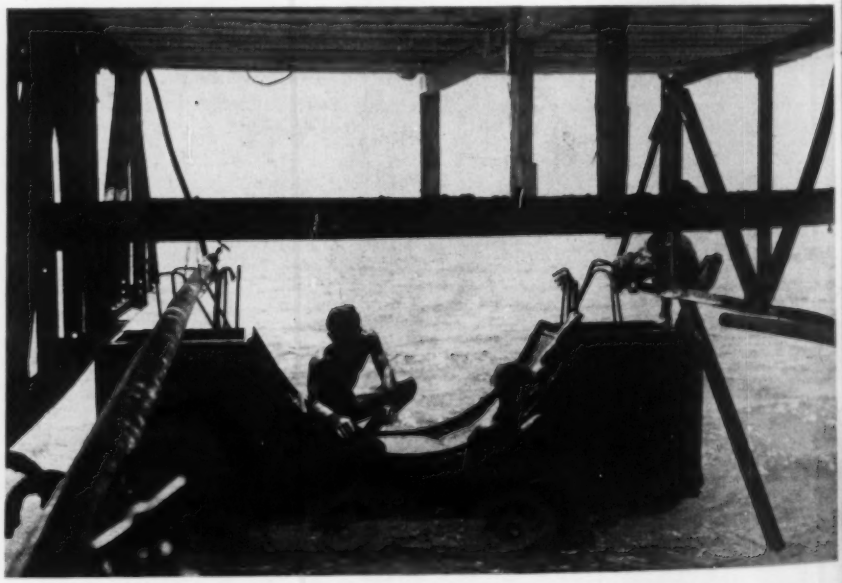
Rigid-frame action in the direction of the jetty, necessary to distribute the forces of oblique shore breakers, is created by two continuous, longitudinally reinforced concrete beams, one along each edge of the semicircular section and anchored to the pile supports by heavy reinforcement. The concrete beams are cast in place on the precast spans, to which they are bound by heavy reinforcing stirrups, as shown in a photograph. After hardening, beams and precast span together form a monolithic section carrying the weight of the sewer pipe and resisting the wave forces in all directions.

Driving and filling of pipe piles, casting of pier crossbeams and placing of precast spans were done with the aid of a forward-moving light auxiliary steel framework 60 ft long, supported on three piers, with the pile-driver cantilevered 20 ft beyond the end of the completed section of jetty. See accompanying illustration.

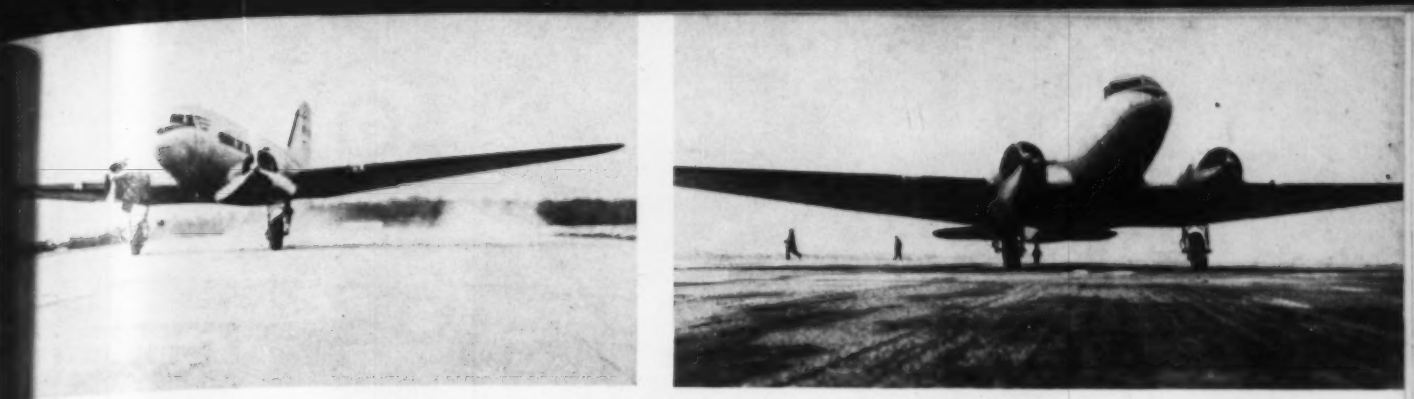
In spite of the relatively high cost of labor ($7 to $10 a day), the cost per foot of the completed tunnel was between $80 and $100, and that of the completed sea outfall, including pipes, between $60 and $70 per ft.

The economy thus achieved was made possible by the fact that the municipality of Tel-Aviv, in particular the municipal engineer, Mr. Ben-Sirah, did not hesitate to accept and endorse a design containing some unconventional features, once it had been carefully checked and found satisfactory by engineering standards.

The contractor was J. B. Gourevitz, with the writer acting as consulting engineer.



STEEL MOLD FOR CROSSBEAM connecting two piles of pier is lowered into position from auxiliary cantilever. Crossbeams, 2½ ft wide, are shaped to form support of semicircular precast spans. Reinforcing bars form rigid-frame connection between piles and crossbeam. Watertight molds prevent washing out of cast concrete, lower edge of crossbeam being about 4 to 6 in. below mean sea level. Tide differences in Mediterranean are small in 24-hr period.



DEVELOPMENT OF CROSS-WIND LANDING WHEELS on DC-3 type transport is expected to cut cost of airport construction and add new points of service to feeder-line operations. New Goodyear wheels make takeoffs and landings practical on one-strip airports regardless of wind direction. Note how airplane crabs into wind and how wheels caster straight down runway in takeoff (left) and landing (right).

Cross-Wind Landings Promote Use of Single-Strip Airports

ANNOUNCEMENT OF A DEVICE which permits cross-wind landing of aircraft has caused widespread discussion as to the possibility of one-strip airports built close in to population centers at a fraction of the cost of multiple-strip fields 10 to 25 miles from town. Los Angeles, for instance, has discussed the construction of a runway to span the Los Angeles River bed which is near the center of the West Coast metropolis, thus placing an airplane terminal within minutes of the center of town and providing access convenience comparable to that offered by bus and rail terminals.

Climaxing a year of development on the new safety device, The Civil Aeronautics Administration and Goodyear Aircraft Corp. recently demonstrated the successful installation of cross-wind landing wheels at Washington National Airport. H. Lloyd Child, assistant administrator of CAA, stated that the demonstration established that one-strip landing fields are practical for light planes in private or commercial use and proved the applicability of swiveled wheel installations to scheduled transport and cargo aircraft as well as to planes in feeder-line service.

Lake-front strips have already been installed on a trial basis or are now under construction or consideration in Cleveland, Chicago, Detroit, Milwaukee and other large centers of population. Cross-wind wheels would make these strips usable in any weather conditions considered safe for multiple-strip fields. A test pilot reports flying a swiveled-wheel-equipped DC-3 in cross winds as high as 40 to 45 mph.

Concrete Caps Protect H-Beam Piles Against Corrosion

ECONOMICAL MEANS IS DEVISED for protecting upper portion of H-beam piles in foundations for Turbine Building of General Electric Plant, Schenectady, N.Y. Method developed by Western Foundation Co. of New York and Chicago for Stone & Webster Engineering Corp., engineers and general contractors on the job, consists of scouring and encasing upper 10 to 30 ft of beam in concrete after piles are driven. Total of 4,666 H-beam piles for Schenectady plant are protected from corrosion by this means. Concrete encasement (below, right) measures 16×16 in. in section for 12-in. 53-lb H-beam, providing minimum of 2-in. concrete protection on all sides. Any type of pile can be similarly protected. Four pile drivers are shown in operation in photo (below, left), three in heavy equipment area driving steel bearing piles and one at left driving pedestal pile in service bay. Two small rigs apply concrete corrcsion-protection to steel piles. At extreme right, concrete is being poured for ground slab in heavy equipment area.

CONSTRUCTION OF modern controlled-access roads, such as Detroit Industrial Expressway pictured here, is made possible by 1941 Michigan state law regulating roadside development. Legislation recognizes that uncontrolled business and residential growth along major arteries interferes with free traffic flow and creates serious accident hazards.

Comprehensive Analysis Shows Extent of Highway Needs in Michigan

PRESENTED IN a recent comprehensive report, prepared by the Highway Study Committee of the Michigan Good Roads Federation under its engineer-director J. P. Buckley, are the basic facts of highway transportation in Michigan, the evaluation of physical needs and the cost of developing a system of roads and streets adequate to serve the economy of the state. The report, titled "Highway Needs in Michigan," credits the Michigan State Highway Department, the County Road Association, the Michigan Municipal League, the Public Roads Administration and the Automotive Safety Foundation for their cooperation in furnishing much of the data contained in the study. This article contains a summary of the facts concerning the development and operation of Michigan highways, roads and streets, gathered and analyzed by the Highway Study Committee, which have been submitted to the governor and state legislature to assist in providing the basic legislation needed.

MICHIGAN, like many other states, faces a critical highway problem. Conditions on its roads and streets have become worse year by year for nearly two decades. With traffic volumes reaching unprecedented levels, a solution to the problem can no longer be put off.

For 15 years the depression and the war prevented normal highway development from meeting expanding needs. Since 1932, despite spectacular increases in motor vehicle traffic, construction on all classes of roadways has been far below the rate in predepression years. About one-fifth less money is being spent on roads and streets today than in the late 1920's.

The result has been a slow but steady deterioration of a great and basic public service. The effects of this deterioration now hamper and, if allowed to continue, soon will severely handicap the business, social, and recreational activities of nearly every person in the state.

There are many signs of this deterioration: the low standard of improvements on thousands of miles of rural roads; worn and inadequate pavements; mounting congestion and frustrating delays on important thoroughfares in city and country; and the rising accident toll on roadways of all kinds.

Since there has not been enough road-building money to go around, it is not surprising that keen competition for funds has developed among highway agencies. At different times, one or another of them has succeeded in persuading the legislature to adopt measures for its individual relief. Meanwhile the proposals put forward to step up highway funds to a level more nearly commensurate with the need have been opposed because all of the facts were not available.

In recent years it has become more and more apparent that piecemeal remedies and rivalries between highway agencies and organizations will solve none of the basic problems. These conditions actually are impeding sound development of highway transportation.

The basic highway problem is clear enough—how to accomplish the double-barreled job of catching up with the accumulated backlog of deficiencies and of meeting current needs as they arise. The solution can be determined only on the basis of all the facts.

Summary of Report's Conclusions

Michigan's entire economy is geared to highway transportation, and dependence on motor vehicles is increasing. Nearly $2.5 billion has

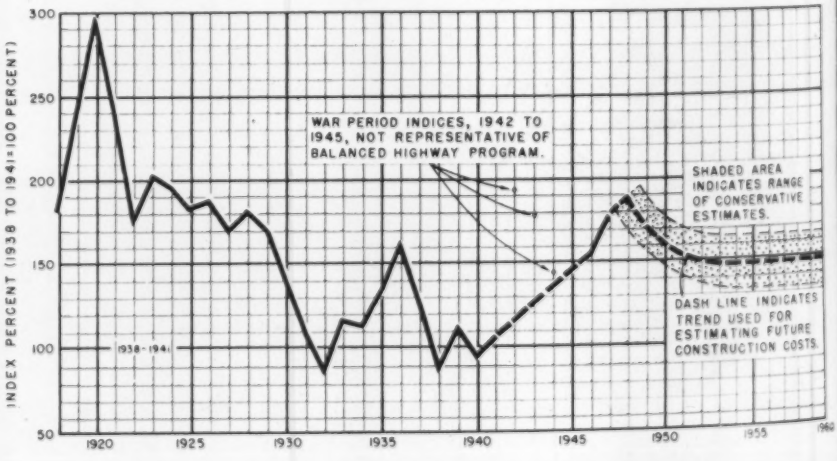
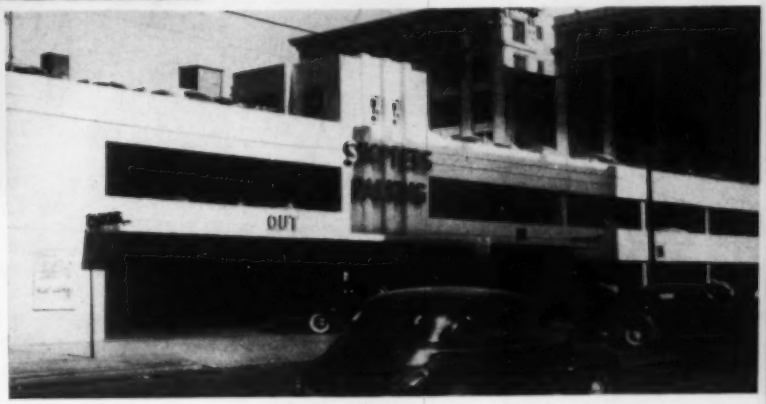


FIG. 1. TREND OF HIGHWAY CONSTRUCTION COSTS in Michigan since 1918—and projection to 1960—is based on unit-price costs of kind and amount of work awarded on state trunklines in 1946. With 1938–1941 prices equaling 100, construction price index now stands at 180. Projected curve is based on continued rise in prices in 1948 followed by downward trend and, by 1953, a period of stabilized prices. Index is expected to level off at between 135 and 165.

ADVANCED STANDARDS OF DESIGN are embodied in traffic interchange (left) now under construction at junction of John C. Lodge and Edsel B. Ford expressways in Detroit. Balanced highway program must include a few such costly developments at heavily congested locations.

OPEN-DECK PARKING STRUCTURE (below) is one answer to off-street parking problem in Detroit central business district. Experience shows, however, that private enterprise alone cannot provide all of parking facilities required in congested areas.



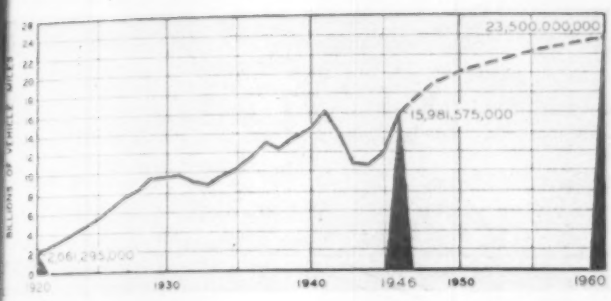


FIG. 2. CURVE OF MOTOR-VEHICLE TRAVEL in Michigan since 1920 (left) is projected to show increase to 23½ billion vehicle miles in 1960. Even at wartime low point, traffic was well above level of boom year of 1929. Total for 1947 is estimated at 17,638 million vehicle miles, or 9 percent above 1941 peak.

HIGHWAY DESIGN PRINCIPLES have come a long way since days of economically unsound plank toll roads (above, left) built in Michigan by private companies in mid-nineteenth century. Arteries such as Davison Expressway (above, right) in Highland Park, Mich., have proved to be most efficient road type for carrying modern traffic loads with safety and driving convenience. Standards adopted by Highway Study Committee call for expressway design on limited mileage of Michigan's most heavily traveled roads and streets.

TRAFFIC CONTROLS on Grand River Avenue, Detroit, most heavily traveled section of roadway in Michigan, show what traffic engineering can do to step up operating efficiency of city streets. Traffic controls instituted since 1940 include elimination of all left turns, and ban on all curb parking during rush hours. During peak hours traffic on two center lanes follows direction of heaviest flow—that is, four lanes are inbound in morning, two outbound, and the opposite at night. Recently "block" system of timing, under which all signals change simultaneously, was substituted for progressive timing system formerly used. Daily load on Grand River Avenue in 1947 was about 56,000 vehicles as against 51,000 in 1940.

MOST TRAFFIC ON RURAL ROADS in Michigan is to or from cities and towns. On rural trunklines and county roads 89 percent of travel is city-to-city, city-to-country, or country-to-city; only 11 percent is from one rural place to another. Also, downtown area attracts far larger share of traffic in Michigan cities than any other zone. Therefore improvement of road facilities leading into and around central business districts of cities is basic step in any attack on metropolitan traffic problems.

been spent on highways and streets since 1910. Current expenditures are 20 percent less than 20 years ago. Motor vehicle registration is more than four times greater now than in 1920; total travel is over nine times greater. Both are still rising. Accidents on the highways likewise are increasing. In 1947 the total of reported traffic accidents reached an all-time peak.

Road and Street Classification. To provide a basis for efficient management and sound financing, Michigan's highways, roads, and streets should be legally reclassified. Some additions and deletions are required on the state trunkline system. The major need, however, is for grouping of county roads into primary and local systems and for grouping of city streets into major and local street systems.

Operation and Maintenance of Roadways. Wider application of traffic-control measures, effective action to provide off-street parking facilities, and improvement of maintenance practices are required to obtain maximum service from existing roads and streets and thus hold construction needs to a minimum.

Physical Standards for Highways. Economy of road operation and maintenance as well as safety and convenience for the motorist requires that roads and streets be improved to the highest physical standards consistent with the amount and character of the traffic they serve. When traffic loads exceed the capacity of a two-lane highway, the road should be replaced by a four-lane divided highway. Average daily traffic above 12,000 vehicles a day on rural roads requires expressway design.

Over-All Highway Needs. Forty-six percent of the road and street mileage within the state is now deficient and requires improvement to meet the demands of today's traffic. Five-sixths of the aggregate expenditures required to overcome present deficiencies are needed on general-service roadways—rural and urban state trunklines, primary county roads, and major city streets—which comprise less than one-third of the state's total road and street mileage. Expenditures required to remedy deficiencies are divided in almost the same proportion as total traffic—a little more than one-half on rural roads and the remainder on city streets.

Costs of meeting present deficiencies are so great that they can only be met through a long-range program. During the period in which deficiencies are being overcome, roads and streets not now deficient will continually wear out and will require replacement. Additional expenditures will be required to maintain the road plant. The cost of correcting present deficiencies in 12 years, together with annual replacement and maintenance costs, would amount to

(*Continued on page 82*)

FIG. 3. DISTRIBUTION OF MOTOR-VEHICLE REVENUES according to cities, counties and state highway department in Michigan has varied widely from year to year primarily because of legislative changes in distribution formulas. Over last 14 years average of almost 56 percent of total net motor vehicle funds has been distributed among counties. Local governments' share has ranged from about 16 percent of total vehicle revenue in 1925 to high of 64 percent in 1943. Curve of total motor vehicle revenue in state shows strong upward trend; even during depression it declined only 17 percent from 1929 peak to low point in 1934, in contrast to precipitous drop in general revenues. The $59 million collected in 1946 was almost three times the 1925 total. Revenue from this source has been increasing at average rate of about $2 million a year.

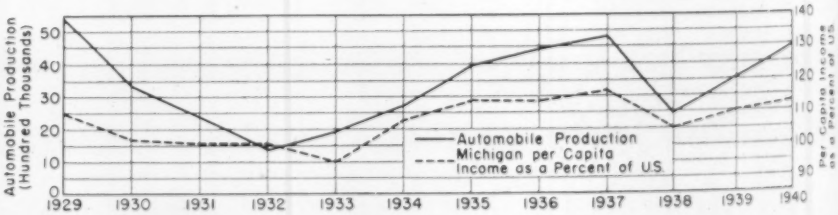


FIG. 4. AUTOMOTIVE PRODUCTION and Michigan's income rise and fall together. Michigan has much to gain by setting pace in road development, especially since highway transportation is vital element in automobile production process itself. Successful mass production of motor vehicles depends on uninterrupted and carefully timed flow of materials, parts and subassemblies to central point for final assembly. To assembly plants at Flint, Detroit, Lansing and Dearborn, trucks haul radiator grilles from Adrian, steering gears from Saginaw, castings from Muskegon, wheels from Jackson, and so on. For distances up to 450 miles, highways are utilized for trucking all except heavier parts.

Technical Writing—An Easily Acquired Skill

JOHN A. MILLER, M. ASCE

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MANY ENGINEERS, discouraged by a feeling that learning to do good technical writing is a herculean task, permit themselves to be satisfied with writing of admittedly inferior quality or, worse yet, do not write at all. To dispel some common misconceptions regarding the difficulties of learning good writing the author reviews certain fundamentals which, if properly applied, should promote better writing.

CRITICISM of the writing ability of the average engineer is heard nearly as often as criticism of the weather. But in neither instance is anybody doing much about it. Some people say that nothing can be done about engineers' writing, that skill at writing is a gift from heaven, and you are either born with it, or born without it. Others say that skill at writing is not particularly desirable, or at least not very important, and there is no need to do anything about it. Before accepting either of these views, let us examine the evidence. Maybe technical writing ability is of real value, and maybe something can be done about developing it.

Those who say that the average engineer can get along well enough without writing ability often contradict their own theory when they undertake to explain what they mean. What they consider unimportant is found to be *fancy* writing rather than *good* writing. Though these critics place a low valuation on writing ability, they still want what is written to be clear, concise and easy to read. And that certainly requires a certain amount of skill at writing.

Does Good Writing Require Training?

Remarks recently made by a nationally prominent business executive illustrate this clearly. Deploring the idea of including more English composition in college engineering courses, he contended that "Literary composition is a pretty unimportant matter in good technical reports." All that is needed, he claims, is that the reports should say what they really have to say in the clearest and briefest possible manner. For that he believes no particular training is needed.

"Young college graduates," he continues, "can express themselves well enough to conduct their personal affairs in a rather complicated world, or they never would have emerged from college." Because many a young graduate understands football and can describe a football game orally "with enthusiastic clarity and fluency," this executive reasons that anyone who understands his subject should be able to do good technical writing.

It would be interesting to record on a dictaphone the average young college graduate's description of the football game, and then have it put on paper for someone who had not been present at the oral presentation. That the written version would demonstrate the talker's enthusiasm seems very likely. That it would describe the game clearly and fluently is, to say the least, questionable. Actually the conditions surrounding an oral presentation are such that we overlook defects that would be glaringly apparent in a written presentation.

Knowledge of Subject Is Not Enough

Many years of experience in reviewing technical papers and articles have convinced the present writer that knowledge of the subject is by no means all that is essential for good technical writing. Knowledge of the subject is the beginning. Without it the writer is defeated before he starts to write. But that alone is not enough. The technical writer must know also how to put his knowledge into words—in the simplest and clearest possible words, and in the smallest possible number of them.

Perhaps an analogy can be drawn from the problem of painting a barn. Everyone knows that barns must be painted from time to time. That is a purely practical matter. Since the building to be painted is a barn we can dispense with the services of an artist to select a color scheme, but we still need someone who knows something about painting. He need not be a professional painter but he must know what kind of paint to use under the existing conditions and how to apply it so that it will not blister or peel in a short time. Everyone will agree that technical reports, papers and articles must be written from time to time. For that kind of writing there is no need for a literary artist, but there is need for someone who knows what words to use and how to put them together.

Anyone Can Learn Technical Writing

Granting, then, that some knowledge of how to write is of real value to the engineer, the question is what can be done to develop it. The people who say that writing ability is a special gift from heaven take a too gloomy view of the situation. Some special gift may be needed to become a Shakespeare or a Mark Twain, but none is required for engineers' reports, papers for engineering societies and articles for technical magazines. Any informed and intelligent person can write them acceptably if he learns the proper procedure and follows it.

Whether or not our engineering schools should devote more time to instruction in technical writing is a subject too complex for discussion here. Much could be said in favor of it. At the same time there are some very real difficulties in the way. In any event there are thousands of young engineers already graduated who could benefit by a serious attempt to develop their writing ability. So let us consider what can be done

IDEAS PRESENTED HERE by the author are based on considerable writing experience. He has written a substantial number of technical papers and articles, one of which received an award from ASCE and another an award from the Society of American Military Engineers. Many of his papers have been accepted and published by various engineering and industrial publications. His books are "Men and Volts at War—The Story of General Electric in World War II" (1947), "Fares Please!—From Horse Cars to Streamliners" (1941), and "Master Builders of Sixty Centuries" (1938). Experience as an editor of the McGraw-Hill Co. for some years, and more recently in handling publicity for the General Engineering and Consulting Laboratory of the General Electric Co., has prompted him to outline a procedure by which the average engineer can improve his writing.

independently of the college curriculum.

Contrary to a prevalent idea, the development of technical writing ability is not a difficult matter. Experienced editors and publishers can cite instances by the hundreds where young men without any unusual gifts have become good technical writers by applying themselves conscientiously to the job. If they have done this, others can do it.

Learning the proper procedure and acquiring facility at it are a good deal like learning to play golf. You can buy a book or take a correspondence course on the subject. We have all seen advertisements of these kinds of instruction. No doubt you can learn something that way, but it's hard to work up much enthusiasm through such impersonal exercise. You can take personal lessons from a professional. That is more fun, but involves following a rather rigid schedule which is not always convenient. Or you can learn casually by getting a little advice here or there, and practicing by yourself. That easy procedure for acquiring writing ability will serve very satisfactorily to meet the needs of the average engineer. It doesn't take much effort—but it does take some. Doing what comes naturally is not quite enough to accomplish the purpose.

Probably the most important step in the development of technical writing ability is to cultivate the habit of putting yourself in the position of the reader of what you write. Try to build up a picture of that reader—who he is, what his interests are, what he already knows about the subject you intend to discuss, and what more he wants to know. Then, as you write, ask yourself what questions will arise in the mind of the reader and whether you are answering them. When you can honestly say that you have visualized the reader, have put yourself in his place, and replied to all the reasonable questions you think he will want answered, you will have assembled the basic material for a good paper or technical article.

Two Ways of Organizing Material

The next step is to organize the material. Some authors like to prepare a comprehensive organization plan before starting to write. Others find it easier to put down on paper all that they have to say and then shuffle the elements around into the most logical order. For most purposes the latter method is somewhat easier. The biggest hurdle in writing a technical article is getting something down on paper, and it's not a bad idea to get over the biggest hurdle right at the start.

Writing without a detailed plan leads to a job of rearrangement after the writer has made up his mind what his plan ought to be. But you can hardly avoid rearrangement no matter how you tackle the problem, unless you have had a great deal of experience. Any comprehensive plan drawn up in advance of writing is likely to prove unsatisfactory as the job progresses and to require modification later. So rearrangement is inevitable at some point in the proceedings, and there are many advantages in direct action—getting essentials down on paper first.

From then on the job is one of polishing. That sounds easier than it really is. Polishing is just as important in writing a technical article as it is in making a roller bearing. A smooth finish is essential for the frictionless functioning of the machinery. You don't want creaking of the machinery in a manufacturing process or in a technical discussion.

On the other hand, you don't need to carry the polishing process to a silly extreme. A split infinitive, or a preposition at the end of a sentence, is not necessarily the awful sin the purists would have us believe. When a critic of this kind attempted to correct Winston Churchill for using a preposition at the end of a sentence, the latter scribbled boldly over the suggested change, "This is nonsense up with which I will not put!"

Extensive Vocabulary Not Required

In a written paper the first thing to be polished is the wording. An extremely extensive vocabulary is not needed, but the author must be sure he knows the exact meaning of all the words he uses. The need for that might be thought to be so obvious as to deserve no mention. Actually a good many authors use words that do not mean quite what they intend to say. Take, for example, the word "unique." This has the very simple meaning of having no counterpart, yet many writers use it as though it had no more significance than "unusual." Misuse of a single word may not confuse the reader seriously, but the greater the number of words that are carelessly used, the more hazy is the general impression created in the mind of the reader.

Of importance equal to that of the author's understanding of the meaning of his words is the readers' understanding. This is something that engineers are prone to neglect. The

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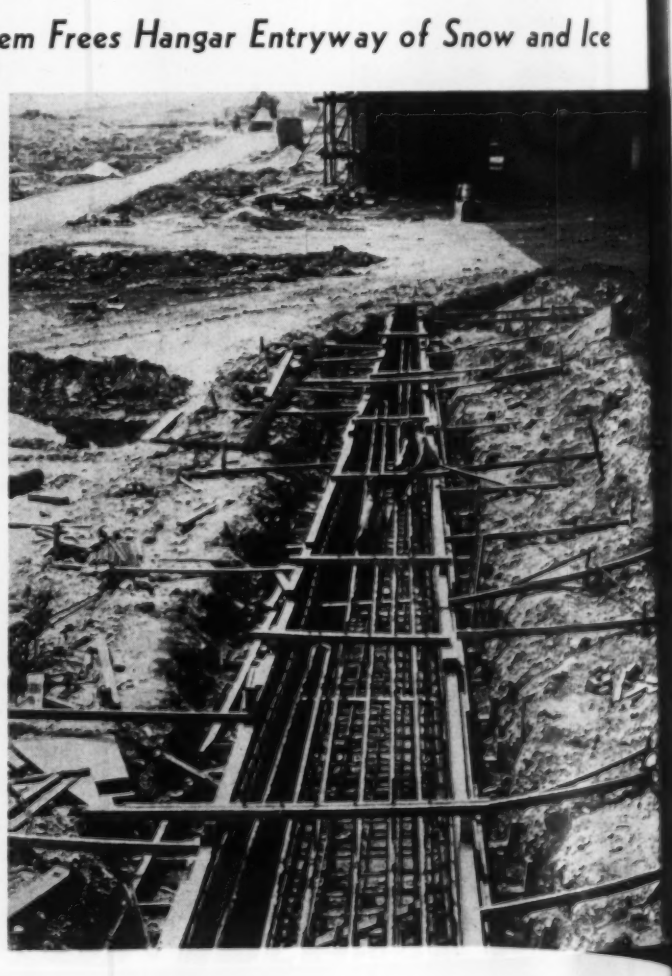
Heating System Frees Hangar Entryway of Snow and Ice



WROUGHT-IRON PIPES embedded in pavement beneath doors of American Airlines' large new hangar at Chicago, carry hot water with anti-freeze added to keep surface temperature above freezing level during winter months. Strip 7 ft wide and 514 ft long is thus kept clear of snow and ice, permitting aircraft to enter and leave hangar easily, regardless of weather conditions. Consisting of almost 2 miles of 2-in. and 2½-in. pipe, snow-melting system is provided with hot water circulated through boiler in hangar. Water is drained when weather moderates in spring and is replaced in fall.

Engineers' Notebook

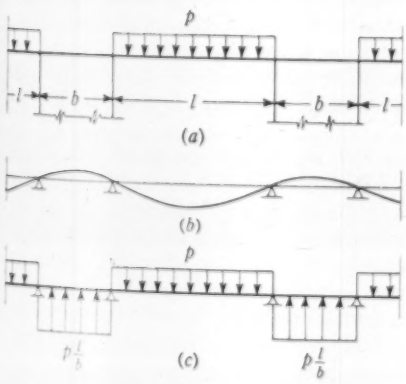
More Exact Analysis Proposed for Continuous Beams Over Flat Supports

A. FLORIS
Los Angeles, Calif.

REINFORCED CONCRETE beams continuous over piers or flat supports are commonly analyzed in two ways, both of which give only crude approximations. In one of these methods, the openings are taken as the theoretical spans of the beam; in the other, the centers of the piers are assumed to be the knife-edge supports of the continuous beam. The first method, permitted by various building codes, furnishes smaller moments than the second. Obviously, neither method corresponds to the actual conditions in the structure. Therefore the writer proposes another way of analyzing such beams which conforms better to the actual conditions of the problem although, as is to be expected, it involves more work.

The continuous beam, Fig. 1 (*a*), loaded with a uniformly distributed load p, over the clear spans l, is supported by piers of length b. Assuming that the piers are rigid and neglecting the weight of the beam, the beam after deformation will take the shape indicated in Fig. 1 (*b*), with knife-edge supports at the junction points of spans l and b. However, the material of the piers being deformable, the edges of the piers will begin to yield so that the pressure of the beam over the pier area will be distributed more evenly. To avoid unnecessary complications, and in view of the approximate nature of such calculations, it is fair to assume that this pressure will be uniform and directed upward. If the downward-directed uniform loading p of the beam extends over the piers, then it must be subtracted from the upward pressure of the piers. Thus the structure is transformed into a continuous beam on knife edges with loadings directed upward and downward (Fig. 1 (*c*)). Further details of the method are given in the following numerical example.

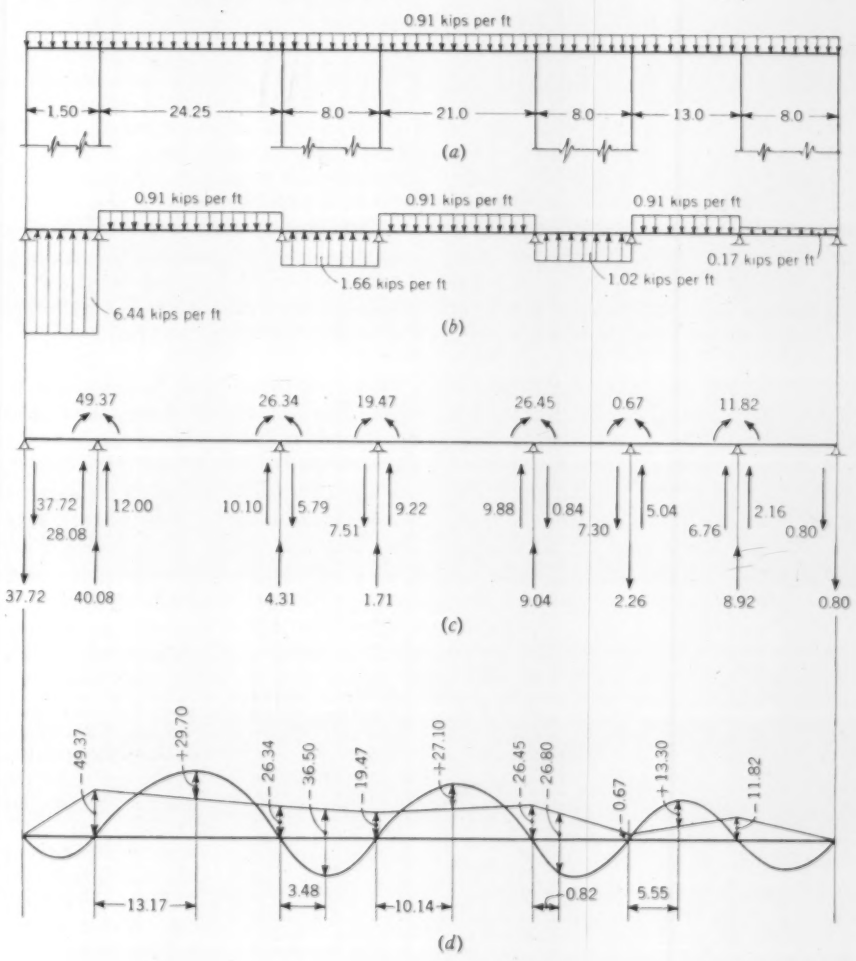
FIG. 1. CONTINUOUS reinforced concrete beam over flat supports (*a*) tends to deform under uniformly distributed load as indicated in (*b*), resulting in load pattern shown in (*c*).



Example Illustrates Method

The reinforced concrete beam, Fig. 2 (*a*), loaded with 0.91 kip per ft, is supported by three concrete piers 8.0 ft long and 1.0 ft thick. The concrete

FIG. 2. EXAMPLE OF continuous beam over flat supports (not drawn to scale) illustrates method of analysis. Dimensions and loadings appear in (*a*); given and reaction loadings of piers in (*b*); calculated moments over supports, shears and reactions in (*c*); and maximum moments in spans, with their location, in (*d*).



column of length 1.5 ft and width 1.0 ft at the left of the beam, is connected securely to walls and beams so that it can be considered rigid. For clearness, Fig. 2 is not drawn to scale. Units are kips and feet.

The reaction loadings of the piers, Fig. 2 (*b*), are obtained by dividing the reactions of the two adjacent clear spans by the sectional area of the pier and subtracting from this the load of 0.91 kip per ft of the beam. With the exception of the pier at the extreme right, all pier loadings are directed upward. The beam and loadings, thus obtained, can be analyzed by any of the well-known methods. It should be borne in mind, however, that in the spans with upward-directed loadings, the signs of the fixed end moments in the moment distribution and slope deflection methods, and the terms depending on the loading in the three-moment equation must be reversed. This necessitates the addition (instead of subtraction) of the moments over the supports to the moments of the beam on two supports in the spans of the piers, if the moments are plotted.

The calculated moments over the supports, the shears and the reactions are given in Fig. 2 (*c*). The maximum moments in the spans and their location are given in Fig. 2 (*d*). All moments over the supports and in the spans are smaller than those obtained by the two approximate methods referred to at the beginning of this article. A new feature of the proposed method is the appearance of negative shears at the ends of the piers. A downward pull of 37.72 kips is necessary to prevent uplift of the left end of the beam.

Prism Device Eliminates One Man from Surveying Party

SERGE A. EMERY
New York, N.Y.

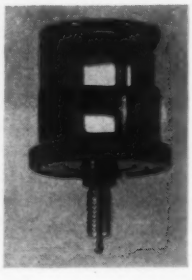
ELIMINATION OF ONE MAN from a property surveying party can be effected through the use of a double pentagonal prism, an instrument which utilizes a set of two prisms. A property surveying party, with transit, usually consists of three men—a chief of party, a transitman and a chainman. If the chief of party is provided with the prism device, the transitman can be eliminated when working on flat or gently sloping terrain, and on problems that contain measurements of few angles other than 90- or 180-deg ones.

There are many types of prisms, but for this work it is best to use the double pentagonal prism, which is about the size of a plumb-bob but considerably lighter. It is a combination of two prisms and has four windows, two in front (one upper and one lower), one on the right side, and one on the left (see accompanying illustration). On the bottom of the instrument, in the exact center, there is a hook to which the string of a plumb-bob can be attached. The prism is held in the right hand and the observer looks into the two front windows. The rays coming from the right and left sides are reflected and broken so that they emerge to the observer on 90-deg angles. For example, a man with a prism, when standing exactly on a line that is defined by range poles at each end, ob serves in the front windows the images of the range poles as forming a straight line, one under the other.

The use of this instrument requires very little training. The preciseness of the usual prism (Winkelprisma) when forming 90-deg angles, according to W. Jordan (Vol. II, p. 49, Stuttgart, 1931) is ±1.1 minutes. This makes a very small error (deviation) in a 100-ft perpendicular.

The two-man surveying party, provided with the double pentagonal prism, can make all measurements on a property survey requiring 90- or 180-deg angles. If it becomes necessary during the day's work to measure one or two other angles, the chief of party can use the transit.

Here are a few examples of how a two-man party works. First, suppose it is necessary to measure the distance between two points. Each point is signalized with a range pole. When the distance is more than 1,000 ft, a third range pole is placed approximately in the middle and on the line with the help of the prism. The measurement begins in the usual manner, the chief of party acting as head chainman. On coming to the "full station," he turns himself so that his body is parallel to the line. He has the tape in his left hand, the prism (with plumb-bob attached) in his right hand. He looks in the front windows of the prism and moves forward or backward until the images of the two range poles come exactly into line, one under the other. Then he fixes the point with the plumb-bob. This point will be exactly on the line. Thereafter he measures the distance in the usual way, repeating the procedure on each succeeding tape.



DOUBLE PENTAGONAL PRISM can be used to measure all 90- and 180-deg angles on property survey. Instrument is about size of plumb-bob but considerably lighter. On bottom is hook to which plumb-bob is attached.

Second, suppose it is necessary to measure the perpendicular distance from a measurement line to the corner of a house (in a house location survey). The ends of the line are signalized by the range poles. The chief of party stands approximately on the line facing the corner of the house. First he moves forward or backward, looking in the prism until the images of both range poles are aligned as before. He is then on the line. Second, facing the corner of the house, he moves to the right or left along the line until the corner of the house is aligned with the images of the range poles in the prism. He fixes this point with the plumb-bob and measures the perpendicular distance in the usual way. This point is exactly on the line because the images of both range poles are aligned in the prism's windows, one under the other. This point is also the base of the perpendicular erected from it to the corner of the house, the corner of the house being aligned with the two images of both range poles in the front windows of the prism.

The two-man party can do many other types of work not mentioned here because of lack of space. Two men with a prism can accomplish the same amount of work as three men with a transit in the same time, or less, since the time necessary for moving and setting up the transit is saved. Worthy of mention also is the fact that a party using a prism can work under a wider range of weather conditions than a party using a transit, since heat and rain, for instance, influence the prism considerably less than the transit. Besides the saving in wear and tear on the transit, there is the direct financial saving realized by reducing the party from three men to two.

...THE READERS Write

What Promise Does Applied Mathematics Future Hold for Engineers?

TO THE EDITOR: Does the work of the applied mathematician in the field of engineering hold the same promise of financial security and professional recognition for the next generation as the field of engineering has for this generation? This question, which I had the occasion to answer recently, may be in the minds of many students who are considering an engineering career in which applied mathematics plays a major role. The following notes reflect my thoughts on the subject.

In the distant past, great technical achievements were the result of the intuition of men of genius, whose scientific background would be considered inadequate for one of our B.S. graduates. These men cultivated the art of engineering and transmitted their knowledge to a few chosen pupils, who spent many years as apprentices in their shops or offices. With the advent of the scientific method, this situation has radically changed. Although it is still true that intuition and practical knowledge play a big role in engineering work, the scientific training imparted in modern engineering schools has "democratized" knowledge to a point where "handbook" engineers can be entrusted safely with routine problems that would have been considered exceptional only a hundred years ago.

The most important tool of the scientific method is mathematics. Through the use of mathematical language and shorthand, it is possible to schematize complicated phenomena and to discover laws or to apply fundamental principles to a variety of engineering problems. Mathematics is the most economical approach to engineering problems. This fact was discovered only recently in the United States under the pressure of the recent war. So many and so urgent were the questions to be answered that the empirical experimental approach had to be abandoned in many cases, and the applied mathematician (or mathematical engineer) was entrusted with the responsibility for the solution of important technical questions. The atomic bomb and the proximity fuse are two outstanding examples of this kind of work.

It must be realized, of course, that the mathematical approach has its own limitations. When a technical problem is very simple, it usually does not pay to recur to mathematics for its solution. There is a time, however, when the use of mathematics pays large dividends, and this is particularly true of problems of moderate difficulty. When the problem becomes extremely difficult, either because of the many essential variables involved or because of the complicated relationships existing between even a few variables, mathematics has to be abandoned in favor of the experimental and intuitional approach.

It happens that the greatest number of problems to be solved by the engineer fall in the intermediate category, in which the use of mathematics is warranted to the fullest extent. Furthermore, the present trend in American industry is toward realizing the importance of the mathematical approach. More and more companies use applied mathematicians as consultants or as full-time workers. The universities have cooperated as fully as possible in developing a type of graduate with a good engineering background and a wide knowledge of mathematical techniques. As the person responsible for the development of a series of courses in engineering mathematics at Columbia University, I can testify to the great interest shown by students in this field of study and to the interest of engineering employers in this particular type of mathematical engineer. All over the country, curricula are being changed in this direction *at all levels*, and while our B.S. graduates are required today to know much more mathematics than their fathers, in many schools degrees in applied mathematics and applied mechanics are being granted at the Ph.D. level.

Our mechanical civilization requires more men of the type described. A scientific knowledge of engineering must be the background for a large number of engineers, if the United States is to maintain her position in the world today. The government, realizing the needs of the country, has proposed special legislation that would open the doors of American universities to a large number of students, who would be financially unable to obtain a degree without outside help. Most of these governmental scholarships would be given in the field of science. Largely through the efforts of the representatives of our engineering societies, engineering has been recognized as one of the fundamental sciences.

I have no doubt that the future will see an increasing number of creative minds happily employed in the field of applied mathematics.

MARIO SALVADORI, Assoc. M. ASCE
Asst. Professor of Civil Eng.,
Columbia University

New York, N.Y.

Slope Protection Project Responsibility Is Explained

DEAR SIR: Mr. Harza's comments, on pages 49 and 50 of the March issue of CIVIL ENGINEERING, apparently need some rebuttal on the part of the writer of the article referred to, entitled "Rock Riprap Replaces Porous Concrete Slope Protection at Santee-Cooper," which appeared in the January issue of CIVIL ENGINEERING.

The writer sincerely regrets that the article proved so annoying to Mr. Harza. Actually, the article blames no one for the failure of the porous concrete. It was a factual story based on records of the project and the writer's official contacts, but it could not be written without at least a note of criticism.

Responsibility for the use of porous concrete on the project probably should be distributed among a number of organizations and persons, as Mr. Harza has indicated. The writer could not and did not attempt such a distribution. His association with the project did not originate until March 1944, nearly two years after the porous concrete slope protection had been completed. To say that the writer "screens his own organization, then known as PWA, from blame and with studied bitterness criticizes those who were between the jaws of the crusher" and that it was written in a "holier-than-thou manner" is to misconstrue the article and to read into it a meaning which it does not have.

It is the writer's view that important failures of engineering materials or structures should be publicized by engineers themselves, in an ethical manner, preferably in their own publications. The sole purpose of the article was to give to the engineering profession the benefit of this very unsatisfactory experience with porous concrete as an upstream slope protection.

HENRY H. JEWELL, M. ASCE
Chevy Chase, Md.

Says Research Is Needed on Waterproofing Rigid Pavements

To the Editor: Mr. Philippe's article on the design of rigid pavements for heavy wheel loads, in the February issue, is an important contribution to this not very well-developed field. It is particularly interesting to the writer because of his observations in England on runways and taxiways, on literally dozens of bomber airdromes, where the pavement, consisting of 6 and in a few cases 8 in. of concrete laid directly on the native soils (clay and colloidal contents between 30 and 40 percent) broke up in some cases under the traffic incidental to the construction itself and, in many other cases, broke up almost immediately when subjected to use by heavy bombers. The only available remedy to keep these pavements in service was to resurface them, either with bituminous mixtures in thicknesses ranging up to 3 in., or with an overlay of from 6 to 8 in. of portland cement concrete. This remedy was not very satisfactory, and in several cases the resurfacing failed rather promptly and had to be renewed.

The foregoing illustrates what seems to be an interesting oversight in the study reported by Mr. Philippe, which is the deteriorating influence on bases or subgrades of surface water entering through the openings in the pavement (rigid)—that is, either the original construction joints or the cracks formed subsequent to construction. From this extensive experience in England, it seems conclusive that, had it been possible to keep the pavement surface waterproof, the difficulty would have been greatly minimized. This conclusion is based on the observed fact that when the thickness of the bituminous "resurfacing" was sufficient (i.e., 3 in.) to prevent the reappearance of the "crack pattern" of the underlying concrete, the "resurfacing" seemed to accomplish its purpose to a substantial degree. But when the thickness of the "resurfacing" was not sufficient (i.e., 1 to 2 in.) to prevent the "reflection" of the "crack pattern" through the resurfacing, the effect of the latter was negligible.

It is interesting to note in connection with the experience in England, that the rainfall in the area involved (the eastern half of the country north of the Thames) was only moderate, the average fall during the war years being slightly less than the normal 26 in. In most of the United States, a much greater amount or rain could be expected to seep through cracks in pavements, making rainfall more of a deteriorating influence than it was found to be in England.

It appears at least possible that the core of the problem of making rigid pavements durable lies in making them waterproof in the first place and keeping them in that condition. Here may lie the real explanation as to why flexible pavements can be thinner than rigid pavements under the same service and base conditions. Unfortunately there is, at present, no known way of making rigid pavements waterproof; hence the importance of bringing this basic weakness out into the open and commencing to work for its correction.

Mr. Philippe's remarks concerning "base courses" are interesting. He seems to deal largely with bases consisting wholly of granular material such as clean gravel, clean sand, cinders, etc. This type of base was very popular with engineers prior to the war and was generally referred to as an "insulation" course. Such bases were used to some slight extent on the work in England just described, where they seemed to serve their purpose no better than they do in America. These comparatively thin "insulation" courses cannot be expected to prove truly effective, since they are ideally calculated to collect moisture and to cause it to do its very worst in saturating the subgrade beneath. Mr. Philippe's concluding sentence, in discussing base courses, indicates that perhaps he has thoughts somewhat similar to those just presented and that he might concur with the theory that the kind of base to lay under a concrete pavement is the same as is required under a flexible pavement—that is, a selected sand-clay or sand-clay-gravel compacted to maximum density, having a definite cohesive value and a substantial degree of imperviousness.

In the paragraph headed "Overlay Performance," Mr. Philippe seems to incline toward the conclusion of the writer—that is, rigid pavements must be made and maintained waterproof so as to prevent water from entering through them into the subgrade, and it is this waterproofing character of the flexible pavement that is perhaps its most valuable physical property. Concentration on the simple problem of making rigid pavements waterproof (once it is conceded that they must be waterproof) should yield constructive results. It should not be too difficult with the present-day "keyed joints" to minimize this and other problems associated with rigid slabs by reducing the slab dimensions and then working out some effective means of insuring the waterproofness of the joints.

Walter C. Carey

New Orleans, La.

Structural Adequacy in Pavement Design Stressed

To the Editor: Mr. Carey's discussion of my article, in the February issue, was read with great interest. Apparently my article failed to lay sufficient emphasis on one basic point—namely, that there is no compromise with structural adequacy. To expand, such factors as proper joints, joint seal, drainage, etc., are necessary for good pavements, but if the pavement is structurally inadequate (not thick enough) then these factors are not sufficient to make the pavement adequate.

His supposition that flexible pavements may be thinner than rigid pavements is hardly ever true for heavy loads, and then only in the case where superlative subgrades exist. There is no doubt, however, that improved sealing and the lack of joints are much in favor of flexible pavements.

Mr. Carey's comments on base course are well taken, but it still remains true that within the scope of the exhaustive tests conducted and the many detailed performance observations there has never been a case where a base course of any type has been *structurally* justified. It is admitted that they are beneficial but not in proportion to costs. This statement must exclude cases where bases are built to enable construction as in bad weather, or for frost action. However, where such steps as these are required, a flexible pavement is usually the cheaper.

I cannot agree on the prime importance Mr. Carey attaches to the waterproofing effect of flexible type overlays. This does not mean that I do not agree that it is very important. However, we have too many measurements of deflection, stress and strain not to know that the presence of these layers produces the desired structural effect with the application of moving loads. It follows, however, that the structural benefit is made more durable by the waterproofing property of flexible overlays.

It must be remembered that the gross weight of our largest aircraft is six times that of the B-17 used in England. One cannot be too impressed with the significance of this increase in aircraft weight and, of course, the lessons that the applications of such loads do teach.

R. R. Philippe, Assoc. M. ASCE

Cincinnati, Ohio

Calls Underground Military Structures Sound Defense Measure

To the Editor: In any consideration of underground military structures, conjecture as to what might have happened and what may happen in the future is very pertinent. If we start by making certain suppositions, we may be able to point out several conclusions. Suppose that a year or so before the attack on Pearl Harbor, our Army and Navy engineers had received instructions to place certain critical structures, such as personnel shelter, counterattack hangars for pursuit planes, ammunition, and supplies, at critical points in the Philippines, on Guam, and near Pearl Harbor. Despite the fact that surprise attacks could still have taken place, I aver the Japanese would not have moved against Pearl Harbor, if they had known such installations were in place.

It should be noted that the Japanese fleet stayed well away, after bombing the island of Oahu on which Pearl Harbor is located, as even with the Air and Navy defenses broken, the few heavy guns on the island were still functioning perfectly. Also, it must be remembered that Corregidor held out for several months, making the Japanese exert their maximum effort.

Now we have even greater danger of surprise attacks. Guided missiles, V-2 bombs, atomic warfare, bacteriological warfare, gas warfare, all confront us. Very few people who face life squarely will state that warfare will not strike this country again and again—unless, and only unless, fear of immediate retaliation, adequate defensive measures, or world control with a proper police force prevent it.

A broad national defense policy, covering protection of vulnerable critical installations with effective means for immediate retaliation, guarding against breakdown of the will of the people and subversive and sabotage activity, is the only hope for safety.

This would require the coordinated effort of our best military, naval and air force minds, with all possible assistance from our political and technological leaders.

Assume that this state of unanimity has been reached, that funds are available and that, after lengthy discussion, conclusions have been reached to establish certain defense areas from which any major attack by any known or probable means could be instantly answered. This letter will not attempt to state the means of possible attack or the possible retaliatory weapons which could be used. It will be confined to discussion of the probable requirements of housing such installations under the following heads: (1) Secrecy, (2) Camouflage, (3) Dispersion, (4) Protection, and (5) Personnel.

1. Secrecy over a term of years on any large project is practically impossible. Workmen move from point to point. Talk in time of war can be suppressed to a certain extent, but in peace some dissatisfied individual is bound to drop a hint in the wrong place. A reasonable amount of secrecy on details would appear to be all that can be hoped for.

2. Camouflage carefully maintained and varied according to the season would add to the security of critical installations particularly in preventing too easy observations of any location arrangement from air or ground.

Mr. Hersum's wartime service includes two and a half years in Military Intelligence, a year and a half as an Artillery Training Battalion commander, and a similar period as chief of the Construction Branch, G-4, HAGFPAC. He was author of an article on "Protective Design for Military Airports" in the December 1940 issue of "Civil Engineering" (page 764). An item on underground facilities as protection against bombing appeared in "Civil Engineering" for July 1947, page 62.

3. Dispersion of supporting installations should be wide enough so that one bomb will not knock out more than one critical setup. In time of peace, of course, this scattering of installations leads to great inefficiency because of the distance involved. Also, once all danger has been eliminated from a particular installation, dispersion may affect the speed with which that installation can come to the assistance of another.

4. *a.* Protection can be carried to an extreme, so that repeated blasts of the heaviest weapons with or without radiation activity or gas cannot have an effect. This so-called 100 percent protection is perhaps offset by a 100 percent inefficiency in so far as retaliation is concerned. Some means must be found to secure a reasonable degree of protection and still remain within effective operation range for instant retaliation and for support of other installations.

b. It has been suggested that an attempt to protect against direct atomic bomb blast is not worth while, unless natural caves or tunnels are available. Other theories are that splinter and flash protection only should be provided. Still others feel that partial protection, such as nearby hills or other natural obstacles would afford, but not protection from direct hits, should be given. Probably this last would be the most reasonable solution. If a direct hit should occur, warning should be given automatically to other supporting centers. This would force the enemy making a surprise attack to the necessity of making direct hits on all retaliatory centers—an almost inconceivable possibility.

c. Structurally, underground protective installations are practical, even though expensive. They have been found generally satisfactory, but the difficulty of securing a satisfactory waterproofing system and good ventilation still remains to be solved in wet or damp locations.

5. *a.* The size of a good fire or police department is based on the probable normal exigencies that occur over a period of years. Added personnel and equipment are brought in from time to time as may be required, and support is obtained from adjacent areas. My contention is that an analogy exists between the military requirements and those of a police or fire department. Families are not housed in police stations or fire stations, and they should not be placed close to active military installations. If they are required to live inside a protective structure, the cost will increase tremendously. As at Bataan and Corregidor, the food supply will rapidly be depleted in an emergency by nonmilitary personnel who come to the Army for protection. As with police and firemen, qualified individuals must be on duty 24 hours a day, every day of the year at these defense centers.

b. In view of the split-second decisions required, the local commander will have to have full authority to act on his own initiative. It may be necessary to have a State Department adviser with each center, qualified to make that Department's view available on call.

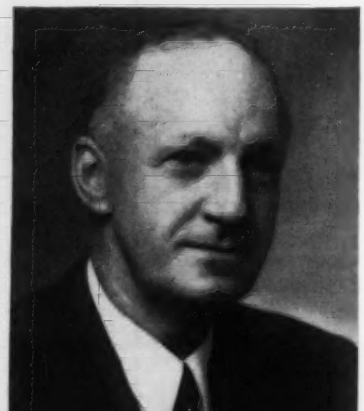
A safe, understandable policy should be presented the public. Once the policy is understood and comprehended, we may be able to develop a sound defense system. Even so, the question of shelter, while important, would be only one phase of the problem.

Leroy M. Hersum, M. ASCE
Consulting Engineer
Boston, Mass.

SOCIETY NEWS

E. L. Chandler Appointed ASCE Assistant Secretary

E. LAWRENCE CHANDLER, for the past four years Eastern Representative of the Society, with headquarters in Washington, D.C., has been appointed ASCE Assistant Secretary by action of the Board of Direction. Since the resignation of James E. Jagger from the post, as announced in the March issue of CIVIL ENGINEERING, Mr. Chandler has been serving as Acting Assistant Secretary.



E. Lawrence Chandler

An alumnus of Brown University, class of 1909, Mr. Chandler spent his early engineering career on sewerage and water supply work for various New England municipalities. He was with the Miami Conservancy District for five years. Then followed twelve years of service as engineer and superintendent of construction in contracting work for Price Brothers Co., of Dayton, Ohio. This work was largely in the field of hydroelectric development.

In 1935 Mr. Chandler became chief engineer of the Chattanooga (Tenn.) Flood Protection District, which he served intermittently until 1941. His work there was interspersed with two and a half years on special assignments and as chief estimator for the Tennessee Valley Authority, and a period as chief construction engineer on the Pensacola Dam in Oklahoma. In 1941 he joined the firm of Charles T. Main, Inc., as project manager in charge of the construction of a large shipyard in Wilmington, Del., and in charge of engineering investigations in Latin America. On March 1, 1944, Mr. Chandler took up duties as ASCE Eastern Representative, in charge of the Washington, D.C., office.

Engineers Needed in ERP Administration, Pittsburgh Chamber of Commerce Is Told

UTILIZATION OF THE engineering profession in administration of the European Recovery Program was called "the surest road to peace and the best way to insure American taxpayers their money's worth" by ASCE Executive Secretary, William N. Carey, in an address before the Chamber of Commerce of Pittsburgh during the Spring Meeting of the Society in that city. Recorded when delivered at the Chamber of Commerce luncheon, the address was broadcast later over one of the Pittsburgh radio stations.

"Basically, the European Recovery Program is aimed at enhancing the standard of living in a large segment of the world which never has enjoyed the blessings we here in the United States are inclined to take for granted," Colonel Carey said. "Its soundness is attested historically by the fact that well-fed nations are not nearly so inclined to war as the underfed countries.

"Since the engineering profession is the one which played such a vital role in bringing about our high American standard of living, it is logical that it should be called upon now to contribute to the well-being of the peoples we are endeavoring to assist through ERP. The engineer's contributions in the recent war, notably in connection with the shortening of that conflict, eloquently state his case.

"Moreover, the engineer can do the enormous job called for under the ERP with the full confidence and respect which American technological superiority has won throughout the world. The engineering profession stands ready to perform in peace as it did in war, with the American know-how which has achieved universal acclaim.

"By planned utilization of the resources represented by the engineering profession, we can make the ERP a matter not merely of dollar assistance, but an instrument for pointing the way to the surest road to peace and, at the same time invoke the best way to insure American taxpayers their money's worth in this gigantic undertaking to avert a war which would all but destroy civilization."

Colonel Carey told the assembled businessmen some of the engineering profession's accomplishments under EJC:

"When I speak of engineers, I do not mean civil engineers alone, or our Society by itself. I am talking about the entire engineering profession. Our profession is represented nationally by the Engineers Joint Council, a federation of our five major engineering societies, which have a combined membership of nearly 100,000. Societies forming Engineers Joint Council are: the American Society of Civil Engineers, the American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, American Institute of Electrical Engineers, and American Institute of Chemical Engineers.

"Among the early contributions of Engineers Joint Council toward peace were two reports which were presented to the State, War and Navy Departments on the all-important subject of how to disarm Germany and Japan industrially without crippling their non-war industries, and thereby avert the danger of making them dependent upon their conquerors. From this start in the field of contributing toward permanent peace, Engineers Joint Council has progressed in stature in the eyes of our government to the point where recently, at the request of the State Department, Engineers Joint Council established a five-man advisory board to consult with the State Department whenever called upon, as well as to advise our Engineers Joint Council representative on UNESCO, the United Nations Educational, Scientific and Cultural Organization.

"I cite these achievements of the profession merely as evidence that not only the public, but the engineer himself, at long last, is awakening to the need for direct participation in working out national and international problems.

"A public expression of the value of engineer participation was given in a *New York Times* editorial over a year ago. The editorial referred to the previously mentioned disarmament reports covering Germany and Japan. After praising one of the reports in detail the *Times* editorial said:

" 'One of the most striking things about

ONE OF BROADCASTS ARRANGED in connection with Society's Spring Meeting in Pittsburgh, depicting work of ASCE and civil engineers, is shown here. Left to right are Col. William N. Carey, ASCE Executive Secretary; Donald M. McNeil, traffic engineer, City of Pittsburgh; C. Glenn Cappel, ASCE Director, New Orleans; and Park H. Martin, executive secretary, Allegheny Conference, Pittsburgh.

the present report is nowhere to be found in it, able document though it is. This is the availability for national purposes of such organized entities as the engineering profession, whose technical competence is matched by its freedom from any suspicion of political motivation. General Clay has acknowledged that the report on Germany has been his most effective instrument in dealing with both the British and the Russians. The latter, in particular, trust American technologists, whereas they look with suspicion upon our diplomats. Our own government might do well to utilize even more fully such a national resource.'

"This is but one indication of the extraordinary position of public responsibility in which the engineer finds himself today. He is the personification of what is referred to and admired around the world as 'American productive genius' or 'American know-how.'

"Our political development has lagged behind our economic growth in the United States. The measure of our economic growth is our standard of living, by far the highest in the world. American engineers have played the greater part in inventing and devising the things and processes which have made our standard of living what it is. Engineers themselves have not fully appreciated this fact; they really haven't thought much about it. They have been too busy and too interested in their immediate jobs to think much about their contribution to the national welfare. Worse still has been their complete disinclination as a profession to become involved in political matters.

"It is only in the last few years that the profession as such has seen the folly of political isolationism. The engineering profession today, as represented by Engineers Joint Council, has successfully demanded of our nation's lawmakers that engineers be declared 'in' on the discussion of many national questions. The State Department, the War Department, the Department of the Interior and other federal bureaus have learned that an engineering profession actually exists and, on occasion, has something worth while to contribute. In the main, we have been welcome in the Washington councils.

"Engineers are needed today in the consideration of many national problems. In Engineers Joint Council, the profession has become effectively articulate on many legislative matters which affect engineers as well as the general public. The profession now has a voice to which national legislators listen. And some of them, like the *Times* editor mentioned earlier, express surprise and gratification in discovering this hitherto unknown source of organized common sense."

Meetings of Board of Direction, April 5 and 6

THE BOARD OF DIRECTION met at the Hotel William Penn, Pittsburgh, Pa., April 5 and 6, 1948. All members of the Board of Direction were present through the two-day session.

The Executive Secretary reported that petitions from each of the four Zones of the Society, signed by many more than the required 75 Corporate Members in each Zone, have been received in the headquarters office. Discussion on both petitions is in order at the Summer Convention. Petition No. 1 contemplates a raise in dues covering all members, and Petition No. 2 eliminates the residential dues differential in District 1. The constitutional changes covered by these petitions are scheduled to go before the Society on ballots sometime after the July Convention. The ballots will be counted next October.

A special committee was directed to prepare a concise statement covering the intentions of the Board of Direction relating to the use of the increased income if obtained or the further cuts in Society activities required if the dues amendment fails to carry. The statement prepared by the committee was approved by the Board of Direction and is covered elsewhere in this issue.

The four Vice-Presidents were appointed to a special committee, working with Directors and Local Section presidents, to bring the advantages of Society membership to the attention of especially well-qualified engineers who are not members.

The Board approved the new constitution of Engineers Joint Council. As soon as all constituent societies of EJC approve it, the new constitution will become effective. A report by a special committee of EJC on the Organization of the Engineering Profession, referred to ASCE by EJC, was given careful consideration. It was decided that this problem should be given further consideration by a special committee of the Society in anticipation of making further recommendations to EJC.

The Board approved the President's appointment of the following delegates on 1948 international conferences, these members to serve without expense to the Society:

Second International Conference on Soil Mechanics and Foundation Engineering, Rotterdam, June 1948: F. A. Marston, Chairman, Carlton S. Proctor, Joel D. Justin, T. A. Middlebrooks, Philip C. Rutledge, T. E. Stanton, and Charles B. Spencer.

Conference on Large Dams, Stockholm, June 1948: Gail A. Hathaway, Chairman, Joel D. Justin, L. F. Harza, C. P. Vetter, and E. M. Dycker, of Drammen, Norway.

International Association of Hydraulic Structures Research, Stockholm, June 1948: J. B. Tiffany, Chairman, Lorenz G. Straub, Boris A. Bakhmeteff, and A. E. Cummings.

International Conference on Large Electric Systems, Paris, France, June 24–July 3, 1948: Philip Sporn, of New York.

The Board considered the financial problems of the Engineering Societies Library and reaffirmed its previous stand to the effect that the ASCE at present could not increase its contributions to the Library.

A review of the present "streamlined" membership application procedure was

studied. It was pointed out that the new procedure has materially reduced the time between the receipt of an application and the election of a member.

The ECPD Canons of Ethics, April 8, 1947, draft, were approved in toto.

The Board directed the Committee on Public Engineering Practice and Policy to study and report on present practice of the U.S. Civil Service Commission regarding engineering examinations and appointments.

The Committee on Districts and Zones reported that its studies show the problem to be too complicated for quick solution. The Committee will continue to study the matter with a view to reporting to the Board at the July Convention.

A report by the Committee on Membership Grades, which has been studying this problem for more than two years, was received and discussed. In view of a probable October 1948 report by ECPD on the same subject, looking to uniform engineer membership grade classifications, action on the ASCE committee report was deferred.

The importance of the Technical Division activities of the Society was stressed. In order that the executive committees of the Technical Divisions, the Division Activities Committee and the Committee on the Budget might discuss the over-all problem, an early meeting of the Technical Procedure Committee with the Budget Committee is planned.

Changing the schedule of the Society from four meetings a year to three, was discussed, and it was decided that the four-meeting schedule would be continued pending possible early over-all revision of the Constitution and By-Laws.

Meetings for 1949 were decided upon as follows:

January—New York, N.Y.
April—Oklahoma City, Okla.
July—Mexico City, Mexico
October—Washington, D.C.

The Mexico City meeting was authorized after repeated requests from Mexican engineers supported by the Mexican government. In authorizing the Mexico City meeting, the Board has provided that official mileage will be paid to officials of the Society only within the continental limits of the United States.

The Board took action directing the Executive Secretary to investigate the "Rules and Regulations of the NLRB" and if necessary, to take steps looking toward inclusion of a directive to regional directors of the NLRB which will assure to professional employees the privilege of deciding whether they will or will not be included in a heterogeneous unit or be represented by any collective bargaining agent.

The Society assumed sponsorship of a new "Council on Research in Reinforced Concrete" to be financed by Engineering Foundation and by private grants.

A new formula for allotments to Local Sections was submitted by the Local Sections Committee. It was taken under advisement for action by the Board at the July meeting. The proposed formula follows:

\$50.00 plus G percent (M plus S),
where G is a factor to be determined by the Board in consideration of the total Society budget.
M is a matching of Local Section dues collected up to a limit of \$2.00 per dues-paying member.
S is an amount of \$50.00 per Student Chapter located in the area of the Section.

The Board approved the recommendations of the Student Chapters Committee that certificates of commendation for the year 1948 and letters of honorable mention be transmitted to the Student Chapters at the following universities:

Certificates of Commendation

Southern Region:
Tulane
Virginia Military Institute
Vanderbilt
Middle Atlantic:
Case Institute of Technology
Johns Hopkins University
West Virginia University
Western Region:
University of Utah
University of California
Southern Methodist
North Central:
Iowa State
South Dakota State College
University of Missouri

Honorable Mention

Southern Region:
Alabama Polytechnic Institute (at Auburn)
North Carolina State
Middle Atlantic:
Bucknell University
Ohio Northern University
Newark College of Engineering
Western Region:
University of Arizona
University of Southern California
California Institute of Technology
North Central:
Kansas State
University of Michigan
Rose Polytechnic Institute

The report by the Committee on Military Affairs was considered. Every effort is being made, supported by the Board of Direction, to attempt to assure full utilization of engineers in the technological activities of the U.S. Department of National Defense.

E. L. Chandler, Eastern Representative of the Society at Washington, D.C., for the past three years, was appointed Assistant Secretary, vice J. E. Jagger, effective April 1, 1948.

New Committee of Sanitary Engineering Division Formed

FORMATION OF A joint procedure committee of the ASCE Sanitary Engineering Division, authorized at the Annual Meeting of the Society in January, has been implemented by appointment of Director Samuel A. Greeley, Chicago, as chairman, and of Francis S. Friel, M. ASCE, Philadelphia, as member.

The purpose of the new committee, which has been designated the Committee on Fundamental Considerations in Rates and Rate Structures for Water and Sewage Works, is to cooperate with the Section of Municipal Law of the American Bar Association, the American Public Works Association, which is organizing similar groups, and other appropriate organizations.

Work, still in the formative stage, will include a description of water and sewage works with reference to rate structures; a definition of terms; a study of the effect of the character of the municipal corporation on rates and rate structures; the assembly and review of enabling acts and charters under which rates and rate structures are made; study of the relation of revenue financing and rate structures to other established methods of financing; a review of important court and commission decisions with regard to rate structures; a review of interesting sewage rates and methods of financing in several representative cities; and the preparation of a bibliography.

EJC Sponsors Publication of Engineering Yearbook

UNDER SPONSORSHIP OF Engineers Joint Council, the American Society of Mechanical Engineers has just issued the first yearbook dealing exclusively with engineering societies. Entitled *The Engineering Societies Yearbook, 1948*, the new publication describes 275 United States and 35 Canadian societies, and eight international organizations. For each national society, information is given on local sections, student branches, and other component divisions.

Engineering joint bodies, and regional, state and local organizations are covered in the publication. There are also sections on engineering employee organizations, state registration boards, and accredited engineering colleges and curricula. All information has been classified and indexed to assist governing bodies of the societies and to facilitate liaison between the societies on matters of common concern.

The new yearbook, first in a projected series of engineering reference works, may be obtained from the ASME, 29 West 39th Street, New York 18, N.Y. Copies are \$3 each.

Constitutional Amendments and Technical Sessions to Share Spotlight

at Seventy-Sixth Annual Convention in Seattle, Wash., July 21-23

CONSIDERATION OF THE proposed Constitutional Amendments regarding Society dues will share the spotlight with technical sessions being arranged for the ASCE's 76th Annual Convention in Seattle, Wash., July 21–23.

Discussion of the proposed dues amendments will be had at the business meeting on the morning of the opening day, at which R. E. Dougherty will deliver the President's Annual Address. Two days of Board of Direction meetings will precede the Convention, and while the Board is in session, a Local Sections Conference also will be held, July 19 and 20.

Seattle Offers Vacation Opportunities

An unusual opportunity is offered engineers to combine their summer vacation trips with attendance at the Annual Convention. Technical programs, covering fields of interest to every civil engineer, have been arranged by seven of the ASCE Technical Divisions. In addition, Seattle engineers are planning a variety of entertainment and excursions in a region that offers exceptional opportunities for sightseeing.

Multiple-Purpose Projects Feature Technical Program

Considerable attention will be given to multiple-purpose water projects, as this subject is particularly important to the Pacific Northwest region. Several of the technical sessions will feature discussions of the Columbia River and its tributaries, with special papers on the numerous major engineering projects contemplated in the further development of the system.

Under sponsorship of the Engineering Economics Division, a special general session will be devoted to discussion of the cost allocation of multiple-purpose projects. Other Divisions planning sessions for the Seattle Convention are the Air Transport, Construction, Soil Mechanics and Foundations, Power, Structural, and Waterways. The program of speakers and their subjects will be printed in the June issue of CIVIL ENGINEERING.

Headquarters for the meeting in Seattle will be the Olympic Hotel. To be sure of obtaining accommodations in the headquarters hotel, it is necessary to make reservations considerably in advance of the meeting. **A special registration form is printed on page 94 of this issue for use in making reservations.**

Make Trip Arrangements Early

Since the meeting will take place at the peak of the tourist and summer vacation season, arrangements should be made at an early date for transportation to Seattle and for any side trips being planned. An accumulation of material from tourist agencies indicates that there are many interesting possibilities for such side trips, and members should consult their local travel agents for information.

Further details of the Convention may be obtained from D. F. Stevens, 709 Seaboard Building, Seattle 1, Wash.

AIR VIEW OF SEATTLE, SCENE OF ASCE Annual Convention, shows Elliott Bay and metropolitan business district. Peak of Mount Baker can be seen in background, left, and part of 26-mile-long Lake Washington, which forms city's eastern boundary, extends in right background.

EJC Asks Highest Technical Use of Engineers Under Any New Draft Law

INSURANCE AGAINST WASTING technical training and experience was urged upon the House Committee on Armed Services during its study of a proposed draft law by Engineers Joint Council. For one of the hearings held by the House Committee, Dr. Lawrence W. Bass, chairman of EJC, prepared a statement on behalf of the EJC constituent societies, whose membership totals 98,000.

Emphasizing that "we are not asking for unwarranted deferment of engineers," Dr. Bass said:

"We are pleading for their use in the most effective capacity, to guarantee that our country and our people derive, in times of stress, the greatest good from this small, highly trained group of citizens."

Dr. Bass, who is vice-president in charge of research and development of U.S. Industrial Chemicals, Inc., was president of the American Institute of Chemical Engineers in 1945, and during the war served as civilian consultant to the Office of the Quartermaster General on research and development and as chairman of the National Research Council Committee on Quartermaster Problems. He outlined for the committee members the types of work for which engineers are trained, pointed out the important part played by engineers in the recent war, and emphasized that while engineers play a vital part in the Armed Services during war, only a relatively small number are needed.

"If now, there is to be industrial mobilization, the engineers will be called on again to implement a preparedness program," Dr. Bass said in pointing up the gigantic task faced by engineers since the war in industrial reconversion amidst materials shortages and a shortage of engineers because of war-interrupted studies.

"Engineers are solidly behind the Armed Services in all their needs for technical personnel used in professional capacities to the extent of their abilities," Dr. Bass said. "If 50,000 engineers were in uniform in the next war, and 20 percent of them—10,000 engineers, a drop in the bucket compared with our total armed manpower requirements—were not used as professional men, this country would waste at least 80,000 man-years of engineering training and experience.

"There are not enough engineers. The depression had its effects in curtailing education, and on top of that came a war which saw the young, logical material for scientific and engineering training, fingering guns instead of slide rules. These shortages, created by economic and martial disruption, will be felt for many years. The vacuum created in technology by a continued shortage of trained men can never be filled.

"The value of the engineers in our economy is a fact—it is not even arguable. To me it seems obvious, in view of their value, and in view of their shortage, that we should conserve those we have. In time of war it would be unthinkable to draft a doctor into any post which did not make full use of his training. Why? Though the answer is obvious, it is made to point out similarities. Physicians are of direct use in maintaining the health of the troops and of the public. Since doctors, too, are in short supply, they must be utilized either in the Army, or in maintaining the health of the civilian population backing up the Army. No doctor is wasted! Now the analogy I wish to make is that engineers fill a similar function from a similar short-supply position. There are not enough engineers, and each ought to be used in his full capacity either as an engineer in the Armed Services, or in maintaining the industrial strength of the country which backs up our military strength. Because the work of the physician is so personal, and the work of the engineer so impersonal, this point doubtless does not occur to everyone. Yet the engineers were not fully utilized in the recent war—a waste equally as serious as though thousands of medical men had been drafted into the Services to scrub barracks as a sanitation measure.

"I think that insurance against wasting technical training and experience can be obtained rather simply. You will recall that there was considerable confusion about the handling of engineers and scientists under the early Selective Service regulations. There finally evolved, based on necessity and hard-won experience, a suitable procedure for conserving our limited supply of technical men. A special committee was set up under the War Production Board, comprised of industrial technical men, which met on a regular schedule, and which considered every case on its merits. This procedure was implemented late in the war by Local Board Memorandum No. 115.

"I recommend for your consideration the establishment of a similar special committee under suitable auspices—the National Security Resources Board, for example—to examine all deferment cases involving engineers, scientists, and technologists. Recommendations for deferment would necessarily rest in a given case upon the following criteria:

1. The training and experience of the individual.
2. His utilization at the highest level of his ability.
3. The importance of his work in the national interest.

"It is essential, further, that an adequate flow of young engineers and scientists be maintained. In my opinion it would be practical to establish, under a suitable agency, a program for selecting a quota of students whose records warranted an opportunity to continue their technical training.

"To provide teaching and research faculties in our technical schools to implement such a program of engineering and scientific training, provision should be made for deferment of qualified men.

"All reports I have seen state that these measures were taken by both our allies and our enemies during the last war. If we are to have the industrial resilience to maintain our position in peace or in war, we must insure an opportunity for our technical men to make their contributions to the national well-being."

CONSTRUCTION DIVISION ACTIVITIES are discussed by group of members at ASCE Spring Meeting. Left to right, are Arthur E. Poole, secretary of Division's executive committee; Charles A. Keelen, vice-chairman of Meeting committee; Frank W. Edwards, secretary-treasurer of Pittsburgh Section; and Prof. Elmer K. Timby, program chairman of Construction Division.

ASCE Spring Meeting Attracts 800 to Pittsburgh

SOME 800 MEMBERS and guests—including 250 Student Chapter representatives—attended the annual Spring Meeting in Pittsburgh. Nine ASCE Technical Divisions participated in the program, including Air Transport, City Planning, Construction, Highway, Hydraulics, Sanitary Engineering, Structural, Surveying and Mapping, and Waterways. Technical discussions of papers pertinent to the various Division meetings followed reading of the papers.

Heading the Pittsburgh committee which was host at the meeting were G. G. Greulich, president of the Pittsburgh Section; C. M. Wellons, general chairman, and C. A. Keelen, vice-chairman. Mrs. William F. Trimble, Jr., headed the large committee of women who entertained women guests at the Spring Meeting.

Pittsburgh Mayor Speaks

Opening the three-day session April 7 was an "Introduction to Pittsburgh" program at which Mr. Greulich extended a welcome to visitors and introduced the Hon. David A. Lawrence, Mayor of Pittsburgh. R. E. Dougherty, President of the Society, responded. A movie, "Pittsburgh, Wonder City of the World," was shown.

A membership luncheon on the opening day was highlighted by a talk prepared by Admiral Ben Moreell, Hon. M. ASCE, president of Jones & Laughlin Steel Corp., and read by Julius Graf, chief engineer of the same corporation, in the unavoidable absence of Admiral Moreell. Excerpts from the address appear elsewhere in this issue.

Steel Plants Visited

Guided tours through the Homestead Works and Irwin Works of the Carnegie-Illinois Steel Corp., a trip to the Pittsburgh Golden Triangle, and a visit to the Jones & Laughlin southside works constituted a portion of the program.

F. S. Merrill, division engineer of the American Bridge Co., Pittsburgh, was chairman of the Spring Meeting Committee on Student Activities and welcomed the 250 Student Chapter members present. President Dougherty addressed a luncheon meeting of the group on "The Young Engineer's Future in His Profession."

Contest winners in the Urban Express Highways Symposium among students were: Norman G. Marks, University of Pittsburgh, first prize of $20 for his paper, "Design of Roadways or Structures"; Willis L. Chilcote, Carnegie Institute of Technology, second prize of $10 for a paper entitled "Traffic Surveys"; and Robert E. Barkley, Case Institute of Technology, third prize, a gift of selected ASCE Manuals of Practice, for a paper on "Economic Justification." Sterling S. Green, research and testing engineer Water and Power Dept., Los Angeles, was chairman of the judging committee.

Social events at the Spring Meeting included a dinner-dance at the William Penn Hotel, convention headquarters, at which Cal Tinney, radio commentator on current events, was leading speaker, a smoker the following evening at the Pittsburgh Athletic Association, and two excursions for women guests—one a tour of Buhl Planetarium and Heinz Chapel, culminating with a luncheon at the University Club, the second a trip to the gardens at Sewickley Heights followed by a lucheon at the Shannapin Country Club, and a fashion show.

Engineering Leadership Through Better Public Relations Urged by Moreell

ASSUMPTION OF LEADERSHIP in national affairs and world efforts for peace through improved public relations were urged upon the members of the ASCE at the opening-day luncheon of the Spring Meeting in Pittsburgh, in a paper prepared by Admiral Ben Moreell, Hon. M. ASCE.

In his paper, the wartime chief of the Navy's Bureau of Yards and Docks, who now is president of the Jones and Laughlin Steel Corp., Pittsburgh, asserted that how to deal with people "is the greatest knowledge which an engineer can have." Julius Graf, chief engineer, Jones and Laughlin Steel Corp., read the paper for Admiral Moreell, who was unavoidably absent.

Citing the engineer's contribution toward America's steadily improving standard of living, Admiral Moreell scored "prophets who, in the 1930's, told us that our economy was mature, would cease to expand; that we had reached the saturation point in our production and consumption of goods; that our frontiers were gone; that there were no new great and undeveloped natural resources to support a growth of the type and scope we had seen in the past; and that, since we could not remain static, there was only one direction in which we could move—backward.

"The demands created by World War II provided needs for production and expansion theretofore unheard of. The response to and the fulfillment of these demands demonstrated how far wide of the mark were those prophets of stagnation. During 1947, two years after the major shooting stopped, our production and the expansion of our industrial and social plant greatly exceeded all of our previous peacetime records; and our need for additional construction, modernization and expansion of industrial facilities alone has been estimated by the President of the United States to total in excess of $50 billion.

"The frontiers of engineers are always before them. The disappearance of geographical frontiers does not 'put the

MEMBERSHIP LUNCHEON SPEAKERS at Pittsburgh Meeting, discussing Society topics, are, left to right, Gen. Brehon B. Somervell, Honorary Member ASCE; ASCE President Richard E. Dougherty; Gerald G. Greulich, president of Pittsburgh Local Section; and Julius Graf, who read paper of Admiral Ben Moreell in latter's unavoidable absence.

engineer out of business,' nor does it reduce his field of activity.

"Some years ago I was asked by the chancellor of the university which I attended to comment, in the light of my experience, on the adequacy of the engineering courses. My comment was to the effect that the technological features of the courses were, in my opinion, adequate but that there was one great deficiency: namely, that not only had the university failed to teach me anything about how to deal with human beings, how to 'handle men,' if you please, but it had not even told me that it was an important thing to know. To me, this is the greatest knowledge which an engineer can have. We accomplish our works through the medium of human beings, and they are all different one from another. You will find that each has his idiosyncrasies, his likes and dislikes, and even his prejudices. I have found that a deliberate study of how to deal with your fellow man is the most important task that an engineer can undertake and attempt to master.

"I have no doubts with respect to the technical competence of the engineer to achieve and to hold his essential status in the future development of our nation and of the world. If, however, he is to attain his full stature, I urge upon him the will to master human relations. Only in this manner can he, in full measure, make his contribution to our progress and to accomplishment, and thus discharge the responsibility which devolves upon him as a vital component of our highly integrated industrial society. By so doing, the engineer will acquire the power to lead and influence people, and with that power comes the greater responsibility to take his place in public life and to assume the larger duties which go with the ability to serve the common interest.

"No profession or calling has greater potential to fulfill the obligation to inspire and to lead in our efforts to make our country and the world a better and more peaceful place in which to live."

ECPD Canons of Ethics for Engineers Adopted by ASCE Board of Direction

APPROVAL WAS GIVEN by the ASCE Board of Direction at its meeting in Pittsburgh to the Canons of Ethics for Engineers as drafted by the Committee on Principles of Engineering Ethics of the Engineers' Council for Professional Development. The Board had discussed the code thoroughly over many months, and acted at the April meeting on recommendation of its Committee on Professional Conduct: Directors Samuel A. Greeley, Harland C. Woods, C. Glenn Cappel, Albert Haertlein, vice-chairman, and F. W. Panhorst, chairman.

In recommending adoption of the code, the Committee stated that with regard to Section 26, it "feels that rewording is desirable but not of vital importance at this time, since there will be an opportunity in the future to make additional minor changes." The ECPD is expected to give additional consideration to the code soon, and ASCE representatives will take up the matter of rewording at that time.

The ECPD Canons of Ethics for Engineers follow:

Foreword

Honesty, justice and courtesy form a moral philosophy which, associated with mutual interest, constitute the foundation of ethics. The engineer should recognize such a standard, not in passive observance, but as a set of dynamic principles guiding his conduct and way of life. It is his duty to practice his profession according to these Canons of Ethics.

As the keystone of professional conduct is integrity, the engineer will discharge his duties with fidelity to the public, his employers and clients, and with fairness and impartiality to all. It is his duty to interest himself in public welfare, and to be ready to apply his special knowledge for the benefit of mankind. He should uphold the honor and dignity of his profession and avoid association with any enterprise of questionable character. In his dealings with fellow engineers he should be fair and tolerant.

Professional Life

Section 1. The engineer will cooperate in extending the effectiveness of the engineering profession by interchanging information and experience with other engineers and students and by contributing to the work of engineering societies, schools and the scientific and engineering press.

Section 2. He will not advertise his work or merit in a self-laudatory manner, and he will avoid all conduct or practice likely to discredit or do injury to the dignity and honor of his profession.

Relations with the Public

Section 3. The engineer will endeavor to extend public knowledge of engineering, and will discourage the spreading of untrue, unfair and exaggerated statements regarding engineering.

Section 4. He will have due regard for the safety of life and health of the public and employees who may be affected by the work for which he is responsible.

Section 5. He will express an opinion only when it is founded on adequate knowledge and honest conviction while he is serving as a witness before a court, commission or other tribunal.

Section 6. He will not issue *ex parte* statements, criticisms or arguments on matters connected with public policy which are inspired or paid for by private interests, unless he indicates on whose behalf he is making the statement.

Section 7. He will refrain from expressing publicly an opinion on an engineering subject unless he is informed as to the facts relating thereto.

Relations with Clients and Employers

Section 8. The engineer will act in professional matters for each client or employer as a faithful agent or trustee.

Section 9. He will act with fairness and justice between his client or employer and the contractor when dealing with contracts.

Section 10. He will make his status clear to his client or employer before undertaking an engagement if he may be called upon to decide on the use of inventions, apparatus, or any other thing in which he may have a financial interest.

Section 11. He will guard against conditions that are dangerous or threatening to life, limb or property on work for which he is responsible, or, if he is not responsible, will promptly call such conditions to the attention of those who are responsible.

Section 12. He will present clearly the consequences to be expected from deviations proposed if his engineering judgment is overruled by non-technical authority in cases where he is responsible for the technical adequacy of engineering work.

Section 13. He will engage, or advise his client or employer to engage, and he will cooperate with, other experts and specialists whenever the client's or employer's interests are best served by such service.

Section 14. He will disclose no information concerning the business affairs or technical processes of clients or employers without their consent.

Section 15. He will not accept compensation, financial or otherwise, from more than one interested party for the same service, or for services pertaining to the same work, without the consent of all interested parties.

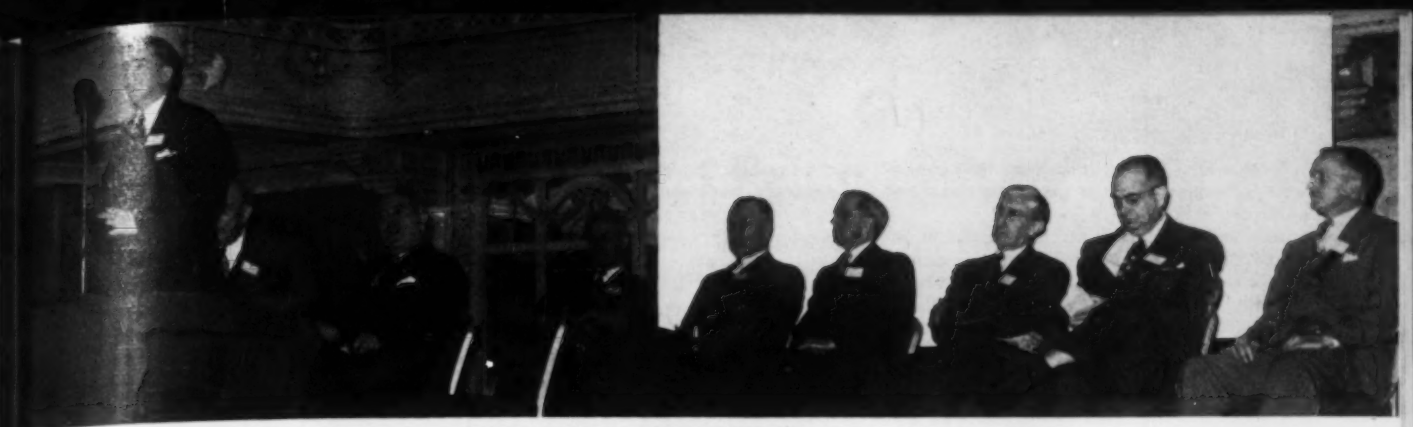
Section 16. He will not accept commissions or allowances, directly or indirectly, from contractors or other parties dealing with his client or employer in connection with work for which he is responsible.

Section 17. He will not be financially interested in the bids as or of a contractor on competitive work for which he is employed as an engineer unless he has the consent of his client or employer.

Section 18. He will promptly disclose to his client or employer any interest in a business which may compete with or affect the business of his client or employer. He will not allow an interest in any business to affect his decision regarding engineering work for which he is employed, or which he may be called upon to perform.

Relations with Engineers

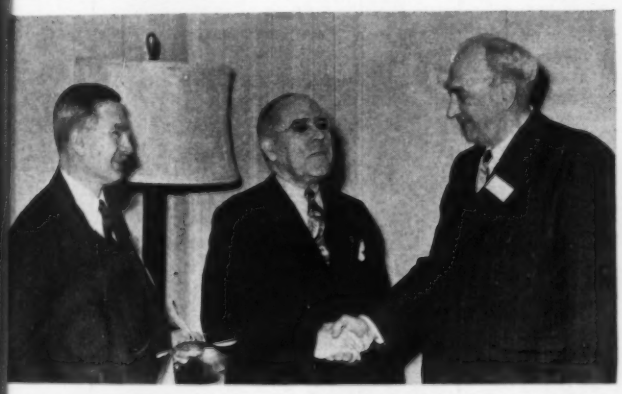
Section 19. The engineer will endeavor to protect the engineering profession collectively and individually from misrepresentation and misunderstanding.



OPENING SESSION OF ASCE Spring Meeting is called to order by G. G. Greulich, president of Pittsburgh Section (above, left). Behind him, left to right, are ASCE President R. E. Dougherty; David Lawrence, mayor of Pittsburgh; D. E. Davis, chairman of Hotel Committee; ASCE Past-Presidents Ezra B. Whitman, W. W. Horner, and E. M. Hastings; Col. C. M. Wellons, chairman of Committee on Arrangements and C. A. Keelen, vice-chairman of committee.

EARLY ARRIVALS among some 250 Student Chapter members from schools in northeastern section of country, who attended Student Conference, give registration desk busy time.

ATTENDING EXCURSION TO steel plants are Morris N. Quade of New York (left), Pittsburgh Section President G. G. Greulich, and Philip A. Franklin, member of Spring Meeting Entertainment Committee.



ASCE PRESIDENT R. E. DOUGHERTY (right) is welcomed by Pittsburgh Mayor David Lawrence (center) and G. G. Greulich, president of Pittsburgh Section of ASCE. Mayor Lawrence delivered opening-day address of welcome.

GATHERED FOR PRE-MEETING CONFERENCE are ASCE Executive Secretary William N. Carey; Col. C. M. Wellons, general chairman of Committee on Arrangements; ASCE President R. E. Dougherty; and Pittsburgh Section President G. G. Greulich.

DELEGATES ATTENDING Local Section Conference are, seated, F. C. Scobey and J. B. Babcock, vice-chairman and chairman of Committee on Local Sections; C. H. Stephens, Dayton; C. J. Stevens, District of Columbia; M. Bogema, Ithaca; M. O. Fuller, Lehigh Valley; and E. L. Shoemaker, Philadelphia. Standing, S. C. McKee, Toledo; L. H. Weinberg, Akron; S. B. Downey, Maryland; D. P. Reynolds, Metropolitan; E. F. Littleton, Northeastern; W. Bauknight, Pittsburgh; A. Hedefine, Metropolitan; L. V. Garity, Michigan; G. B. Earnest, Cleveland; C. F. Renz, Cincinnati; G. E. Large, Central Ohio; and R. G. Champagne, Mohawk-Hudson.

Section 20. He will take care that credit for engineering work is given to those to whom credit is properly due.

Section 21. He will uphold the principle of appropriate and adequate compensation for those engaged in engineering work, including those in subordinate capacities, as being in the public interest and maintaining the standards of the profession.

Section 22. He will endeavor to provide opportunity for the professional development and advancement of engineers in his employ.

Section 23. He will not directly or indirectly injure the professional reputation, prospects or practice of another engineer. However, if he considers that an engineer is guilty of unethical, illegal or unfair practice, he will present the information to the proper authority for action.

Section 24. He will exercise due restraint in criticizing another engineer's work in public, recognizing the fact that the engineering societies and the engineering press provide the proper forum for technical discussions and criticism.

Section 25. He will not try to supplant another engineer in a particular employment after becoming aware that definite steps have been taken toward the other's employment.

Section 26. He will not compete with another engineer on the basis of charges for work by underbidding, through reducing his normal fees after having been informed of the charges named by the other.

Section 27. He will not use the advantages of a salaried position to compete unfairly with another engineer.

Section 28. He will not become associated in responsibility for work with engineers who do not conform to ethical practices.

Army Research and Development Group Studies Utilization of Officer Skills

AS A SECURITY measure, a program to ensure the best utilization of Army reserve officers, professionally engaged in research and development, was presented by the Army to a committee of scientists and engineers who hold commissions in the Organized Reserve Corps, at a recent meeting in Washington, D.C.

Under the plan drawn up by the Scientific Manpower Section, Research and Development Group of the Army's Logistics Division, organized reserve officers with research and development training and experience will be able to utilize their technical skills during active duty training assignments in the Army and in group projects while on inactive duty. In case of emergency, they would be available for mobilization with a minimum of waste motion.

Headed by Brig. Gen. Norman W. Lack (Eng. Res)., of Wilmington, Del., the committee of engineers and scientists meeting in Washington included Col. William N. Carey (Eng. Res.), Executive Secretary of the ASCE; Col. C. E. Davies (Ordnance Res.), secretary of the ASME; Col. J. H. Ferrick (Sig. C. Res.), personnel director for the Gulf Research and Development Laboratory, Pittsburgh; Maj. R. B. Finch (Q. M. Res.), Massachusetts Institute of Technology; Maj. R. A. Sloan (M. C. Res.), of the Army Institute of Pathology; Lt. Col. A. S. Behrman (A.M.S., Res.) consulting chemist, Chicago; and Col. J. N. Andrews (Inf. Res.), of the Veterans' Administration. Maj. S. C. Rothmann, of the Logistics Division, served as secretary for the committee.

Speakers included Maj. Gen. A. C. McAuliffe, Deputy Director of Logistics for Research and Development, Maj. Gen. J. C. Dahlquist, Brig. Gen. B. F. Caffey, Brig. Gen. Wendell Westover and Col. E. A. Routheau.

The first of the purely research and development organized reserve groups was established in 1947 by General Lack and reserve officers located in the Wilmington, Del., area. Other units are now being formed in Philadelphia and Urbana, Ill., and it is expected that similar groups will be established throughout the country in localities where there are sufficient numbers of reserve officers eligible for the program.

A recent survey of members of the ASCE and ASME, made by those societies in cooperation with the War and other Federal Departments (see CIVIL ENGINEERING for April 1948, page 49), shows them to be overwhelmingly of the opinion that their technical training was not used to the best advantage in either military or civilian wartime service. It is in the hope of avoiding similar misuse of engineering and scientific skills in the event of emergency, that the present peacetime program of research and development is being worked out.

RESERVE OFFICERS, MEETING IN WASHINGTON RECENTLY to discuss details of Army program of research and development are, seated left to right, Col. C. E. Davies, Ordnance Dept. Reserve and secretary of ASME; Col. William N. Carey, Engineer Corps Reserve and Executive Secretary of ASCE; Col. E. A. Routheau, chief, Research Branch, Research and Development; Brig. Gen. Norman M. Lack, Engineer Reserve chairman; Maj. Gen. A. C. McAuliffe, General Staff Corps, Logistics; Maj. Gen. John E. Dahlquist, General Staff, P & A; Brig. Gen. Benjamin F. Caffey, O & T, General Staff; Col. James H. Ferrick, Signal Corps Reserve; and Lt. Col. A. S. Behrman, Medical Service Corps Reserve. Standing, in same order: Col. John W. Andrews, Inf. Reserve; Lt. Col. V. M. Elmore, General Staff Corps, Research Group; Maj. S. C. Rothmann, GSC, Research Group; Dr. Ruell A. Sloan, Maj., Medical Corps Reserve; Maj. Robert B. Finch, Quartermaster Corps Reserve; and Dr. David M. Delo, chief, Scientific Manpower Branch, R & D Group.

Statement of Policy

By the Board of Direction, American Society of Civil Engineers, at its April 1948 meeting, which statement has been edited by a majority of the Committee on Public Engineering Practice and Policy.

THE AMERICAN SOCIETY of Civil Engineers has a membership of over 20,000, employed in all phases of our political economy, including responsible positions in government—national, state, county and municipal, and including also those engaged in technical instruction and in the private practice of engineering. The Society believes that, because of the diversity of its professional activities, its national standing and the fact that it represents the great majority of Civil Engineers in the United States, it has a clear responsibility in respect to the profession and the various public agencies.

1. The Society is particularly concerned with the administration of those public Agencies having engineering duties or related tasks to perform and believes that to the best of its ability, it should see to it that such administration is carried out in the best interests of both the public and the profession.

The Society therefore will cooperate to the fullest extent with the heads of all Government Agencies employing engineers to the end that the above responsibility may be met, but will take appropriate action whenever in its opinion the interests of the public and the profession are adversely affected.

2. The Society recognizes that within certain Governmental Agencies and Institutions, including the technological departments of our universities, there are employed Engineers of special technical skill, whose advice is sought by both private and Governmental agencies and institutions. The Society believes that this specialized talent should be available only to those who seek it, but that such services should not be offered or rendered except with the knowledge and consent of the Institutional or Agency authority. The Society does not, however, approve of such Engineers maintaining a private office and a staff either by themselves or with others in direct competition with Engineers not in the public employ.

3. The Society recognizes that there are in some of the Government Bureaus administrative positions which carry a highly technical responsibility. The Society points out that these positions are frequently filled by men with no engineering training, and that such lack of technical qualification may work to the disadvantage of the general public as well as the Bureau concerned, of the Engineering employees of the Bureau and lowers the prestige of the Engineering profession. The Society recommends that such administrative positions, especially those that supervise large numbers of engineers, should be filled by men of suitable technical training. The Society will therefore use its best efforts to encourage this policy.

4. The Society recognizes that during peacetimes, the Army and Navy and air forces should be maintained and trained in the art of warfare; but it believes also that it is essential to maintain a strong group of Engineers in private practice. The Society also recognizes that there are certain types of engineering projects, in which the public interests may be best served, by doing the work of engineering with the staffs of the responsible Bureaus. The Society is pleased to note that many of the Governmental Agencies have already adopted a policy of contracting with private engineers to furnish technical services. The Society desires to use its best efforts to maintain these relations.

5. The Society has observed that, frequently, certain Governmental Agencies have engaged in the promotion of, and negotiations for, Engineering work of Irrigation, Drainage, Land Reclamation, Power, Water Supply, Air Ports, Housing and other projects, to the end that the Engineering staffs of the Agencies may be continuously employed. The Society does not believe that the best interests of the Public are served in many of these instances, especially in the medium and smaller sized projects, and will use every effort to discourage similar practices in the future.

6. The Society recognizes that within certain Governmental Agencies, there are administrative problems that may relate largely to staff procedure, office locations, territorial responsibility, etc., and that may affect the economic status of its Engineer employees. The Society believes that, so long as the individual engineer employee is accorded opportunities for professional advancement, and so long as the effectiveness of the engineering staff is not weakened by the proposed changes, the Society should take no cognizance of such administrative or organizational matters.

7. The Society recognizes that it is in the interest of the Goverment of the United States that the best technical information and the best qualified talent in the country be made available to other nations requesting services needed to solve their domestic engineering problems, and that this assistance may require the temporary assignment of properly qualified individual specialists, selected either from government service or private enterprise, as advisers to other governments together with such assistance as may be necessary for the accomplishment of their individual assignments; however, the Society does not believe that any Federal Agency should be permitted to prepare engineering designs, plans and specifications for, or engage in supervision or construction of, projects for foreign governments unless the national interest demands such actions. The Society will therefore exert effort to obtain compliance with the above policy in connection with requests from foreign governments for technical services.

Robert B. Brooks, Chairman, Consulting Engineer, St. Louis, Mo.

Nathan C. Grover, Senior Engineer, U.S. Geological Survey, Washington.

James P. Growdon, Chief Hydraulic Engineer, Aluminum Company of America, Pittsburgh, Pa.

Sections Sponsor Fluid Mechanics Conference

ASCE LOCAL SECTIONS in California—Los Angeles, Sacramento, San Diego, and San Francisco—are co-sponsors of an informal Institute on Heat Transfer and Fluid Mechanics, scheduled for Los Angeles, June 21-23. The conference, which will feature papers on the basic nature of heat transmission and fluid flow, will be held for one day each on the campuses of the University of California (Los Angeles), the University of Southern California, and the California Institute of Technology.

Other cooperating groups are California sections of the AIChE, the ASME, the American Society of Heating and Ventilating Engineers, and the Institute of Aeronautical Sciences, the Fluid Mechanics Division of the American Physical Society, Stanford University, the University of Santa Clara, and Project SQUID—a cooperative research project of five Eastern universities.

Board Adjusts Expenditures Policy in Line with Decision on Dues

SOCIETY FINANCES were discussed in detail by the Board of Direction at its quarterly meeting preceding the Spring Meeting of the ASCE in Pittsburgh. The Executive Secretary reported that petitions from each of the four Zones, signed by many more than the required 75 Corporate Members in each Zone, have been received. At the direction of the Board, the following statement was prepared by a special committee, and copies of it are being sent to the presidents of all Local Sections for their information:

"If the Amendments providing for increases in dues are adopted, it is the intention of the Board of Direction to devote this increased income to

(1) **Publishing the Yearbook in 1949.**
(2) **Increasing the allotments to Local Sections approximately to the 1947 level.**
(3) **Maintaining publications at the present or approximately the present level.**
(4) **And if there is still a balance remaining, consider increasing allotments to publications and to technical and professional activities.**

"If the Amendments are not adopted, it will be necessary to curtail expenditures below the 1948 level by about $25,000.00. The principal sources of this decrease are the following or some combination thereof:

(1) **Eliminating one or more of the branch offices.**
(2) **Reducing the volume of publications (or charging a subscription price for "Proceedings")**
(3) **Reducing still further contributions to Local Sections.**

Submitted,
ROY W. CRUM
IRVING V. A. HUIE
W. N. CAREY
GEORGE W. BURPEE, *Chairman*"

Discussion of the proposed Constitutional Amendments covering dues increases will be in order at the Summer Convention in Seattle, July 21, and it is expected the amendments covered by these petitions (1) raising dues $5.00 for all Corporate Members and Affiliates, and $2.50 for Juniors and (2) eliminating the residential dues differential in District 1, will go to ballot late this summer or early in the fall.

Membership Grade Changes Recommended by Committee

FOLLOWING A STUDY of more than two years, which included results of a questionnaire conducted among the ASCE membership last year, the Committee on Membership Grades submitted a report to the Board of Direction at its Spring Meeting, recommending:

Amalgamation of the present grades of Member and Associate Member into a single new grade of Member, so that there will be but one grade in the Society having full corporate rights, that of Member.

Changing the title of the present grade of "Junior" to that of "Associate Member," and granting the same limited corporate rights to these members as are granted to the present grade of Junior—that is, the right to vote, but not to hold office.

Creation of a new non-corporate grade of "Student Member," limiting membership to upper classmen in accredited engineering schools.

Provision for ultimate elimination of the present grade of Fellow.

Action on this report was deferred in view of a probable report in October by ECPD, looking to uniform engineer membership grade classification.

Reprints of Panama Canal Symposium Are Available

A SYMPOSIUM ON the Panama Canal, treating the proposed $2^1/_2$-billion-dollar sea-level project, appears in the April issue of PROCEEDINGS. Every member will receive this material, which has been prepared by outstanding authorities, in his regular copy. In addition, specially bound reprints of the symposium are now available at a cost of $1 each. Orders will be filled promptly at Society Headquarters.

Boston Society of Civil Engineers Has Centennial

CELEBRATION OF THE centennial of the Boston Society of Civil Engineers was launched at a recent meeting of the organization with a symposium on "Contributions of the Members of America's Oldest Engineering Society to 100 Years of Progress in Civil Engineering." Participants in the symposium were Charles B. Breed, Gordon M. Fair, Charles M. Spofford, and Howard M. Turner, all Members ASCE, who summarized engineering achievement in the fields of transportation, sanitation, structures, and hydraulics.

Founded in Boston in 1848 "for the professional improvement of its members, the encouragement of social relations among engineers and men of practical science, and the advancement of engineering," the Boston Society of Civil Engineers was the first engineering society in the United States.

To serve the technical interests of its members, the organization has five technical sections and a student section at Northeastern University, and maintains an engineering library at its headquarters in the Tremont Temple, Boston. Other activities include publication of the *Journal of the Boston Society of Civil Engineers* and the annual award of prizes for outstanding papers.

In honor of the society's anniversary, the ASCE will hold its Fall Meeting in Boston in October as part of the centennial celebration.

COMMITTEE ON EMPLOYMENT CONDITIONS gathers for discussion at Pittsburgh Spring Meeting. They are, left to right, Hibbert M. Hill, Gail A. Hathaway, Sterling S. Green, Armstrong Chinn, and Ernest Whitlock.

NEWS OF LOCAL SECTIONS

Scheduled ASCE Meetings

ANNUAL CONVENTION
Seattle, Wash., July 21–23
(Board of Direction meets July 19–20)

FALL MEETING
Boston, Mass., October 13–15
(Board of Direction meets October 11–12)

Coming Events

Central Ohio—Meeting at the Chittenden Hotel, Columbus, May 20, at 6 p.m. There will be a symposium on civil engineering as a career.

Cleveland—Meeting at the Cleveland Engineering Society, Cleveland, May 21, at 8 p.m. Seniors of Case Institute of Technology will be guest speakers, presenting theses in brief. Meeting preceded by dinner at 6:30 p.m.

Colorado—Dinner meeting at the Oxford Hotel, Denver, May 10, at 6:30 p.m. "Student Night" program sponsored by the University of Colorado. Dr. Frederick Rohrman, executive director of the Engineering Experiment Station at the university, will discuss the Station.

Georgia—Meeting at the Georgia School of Technology dining hall, Atlanta, May 6, at 6:30 p.m. There will be inspection of the school's laboratory facilities together with talks.

Hawaii—Meeting at a place to be announced, in Honolulu, May 26, at 6:30 p.m.

Iowa—Meeting at Iowa State College, Ames, May 5, at 7:30 p.m. R. W. Rausch will speak on "Conveyor Systems."

Kentucky—Joint meeting with the Student Chapters of the University of Kentucky and the University of Louisville, at Lexington, May 21, at 6:30 p.m.

Louisiana—Meeting in Parlor "A," St. Charles Hotel, New Orleans, May 31, at 8 p.m.

Maryland—Meeting at the Engineers Club, Baltimore, May 19, for the annual informal entertainment program, following cocktails at 6 p.m.

Metropolitan—Meeting in the Engineering Societies Building, New York, May 19, at 8 p.m.

Michigan—Meeting at the Union Building, Michigan State College, East Lansing, May 6, at 6:30 p.m. Prof. W. L. Mallmann will speak on "The Bacteriological Engineer."

Northwestern—Meeting in the Junior Ball Room, Coffman Memorial Union, University of Minnesota, Minneapolis, May 3, at 6:30 p.m. Prizes for senior civil engineering students at the Universities of Minnesota and North Dakota, North and South Dakota state colleges, and the South Dakota School of Mines will be awarded.

Philadelphia—Meeting, conducted by Junior Forum, at the Engineers Club, Philadelphia, May 11, at 7:30 p.m., on "Housing." Preceded by dinner at 6 p.m.

Sacramento—Meetings at the Elks Club every Tuesday at noon. No meetings on holidays; special meetings as announced in the "Engineerogram."

St. Louis—Luncheon meeting at the Hotel York, St. Louis, May 24, at 12:15 p.m.

San Diego—Meeting at San Diego State College, San Diego, May 18. San Diego State Engineers' Association, student group, will be hosts, with Dr. Chesney Moe of college faculty speaking on "Acoustics in Engineering." Tour of the campus at 6 p.m.; dinner at 7 p.m.

Tennessee Valley—Spring meeting at George Vanderbilt Hotel, Asheville, N.C., May 7 and 8.

Texas—Meeting of Dallas Branch at Adolphus Hotel, Dallas, May 3, at 12:15 p.m.

Virginia—Joint meeting with the Engineers Club of Hampton Roads at the Nansemond Hotel, Norfolk, May 13–14. ASCE portion of program will be at 1 p.m., May 13.

West Virginia—Meeting at the Hotel Morgan, Morgantown, May 7, for an afternoon trip and evening session. H. E. Anderson, head of the projects branch, engineering division, District Engineer's office, Pittsburgh, will talk on proposed canalization of the upper Monongahela River at evening meeting.

Recent Activities

ARIZONA

PROBLEMS ENCOUNTERED IN the manufacture of steel were discussed at a recent meeting by Frank Foltz, chief draftsman of the Allison Steel Manufacturing Co. Mr. Foltz also described the composite type of building being fabricated by his organization, supplementing his talk with motion pictures depicting fabrication and construction processes. Discussion from the floor, following his talk, centered around the adaptation of such structures to home building needs. Topics discussed during the business session included recommendations of the local EJC committee for job classifications, the proposed redistricting of Local Sections, and the Arizona Section budget.

CENTRAL ILLINOIS

DRAINAGE AND RECLAMATION of the Zuyder Zee was the subject of a talk given at a recent dinner meeting by Albert E. Cummings, director of research for the Raymond Concrete Pile Co. By construction of earth dams or dikes, Mr. Cummings said, Dutch engineers have made available for agricultural use 50,000 acres of land formerly at the bottom of the Zuyder Zee. Current construction projects in the Netherlands include the building of a 15-mile-long earth dam that will separate the Zuyder Zee from the North Sea and convert it from a salt-water tidal body to a fresh water supply. During the evening W. H. Munse, president of the Junior Branch of the Section, reported on the activities of the organization since its formation last November.

CENTRAL OHIO

ACTIVITIES OF THE Ohio State Division of Conservation and Natural Resources were outlined by William E. Owens at a recent dinner meeting. In particular, Mr. Owens stressed the cooperative work of the Division with other state and federal agencies in such matters as flood control, water supply, and pollution abatement. Showing of a film on wild life in Ohio concluded the program.

CLEVELAND

DESIGN FEATURES OF the Nottingham intake of the Cleveland water works, a current water supply project that will benefit the eastern side of the city and its environs, were discussed at a recent meeting. The featured speaker was Alfred A. Burger, of the Cleveland firm of Havens & Emerson, consulting engineers on the project. Part of an overall program of expansion and improvement being put into effect by the Cleveland Utilities Department, the new project will make available to the city an additional supply of 200 mgd.

COLORADO

TRAFFIC ENGINEERS MUST make use of all the facilities at their disposal in attempting to solve Denver's traffic problems, Henry A. Barnes, director of traffic engineering for the City and County of Denver, told members of the Section at a recent meeting. Such facilities include traffic signals, reflectorized pavement

striping, speed limits, through streets, standard signs, adequate parking, one-way streets, elimination of blind spots at corners, and car inspection. Mr. Barnes stated that the three "E's" of traffic safety—Engineering, Education and Enforcement—cannot be emphasized too strongly.

GEORGIA

THE IMPORTANCE OF soil structure in foundation engineering was emphasized by George Sowers, assistant professor of civil engineering at the Georgia School of Technology, at a regular monthly dinner meeting. William J. Greene, Jr., chairman of the Section's Committee on Juniors, was in charge of the program, which was planned and conducted by Juniors. Showing of motion pictures of recent Georgia Tech football games and a brief business session concluded the meeting.

DISTRICT OF COLUMBIA

IN A TALK on "Engineering in Postwar Military Construction," presented at a recent Section meeting, Col. Fred S. Poorman outlined the organization and operation of the Army Corps of Engineers Engineering Division, of which he is assistant chief. Of special interest was the subject of construction in the Arctic, where muskeg presents a difficult foundation problem. Aluminum barracks have been developed for use in such areas, Colonel Poorman said, and their light weight permits them to be transported by air. The group was also interested in a description of proposed tests of the effect of varying quantities of explosives on underground structures. Development of a uniform plumbing code was the subject of discussion at another recent meeting. The background of the code, which is now being published, was described by Leonard C. Haeger, director of the technical office of the Housing and Home Finance Agency. Mr. Haeger discussed research and tests carried out at the National Bureau of Standards, while the code was being formulated, and Vincent T. Manas, chairman of the Uniform Plumbing Code Committee, showed a moving picture of the tests.

FLORIDA

MODERN TRENDS IN steel construction were covered at a joint meeting with the Structural Engineers Council of Jacksonville by T. R. Higgins, director of engineering for the American Institute of Steel Construction. Mr. Higgins discussed secondary structural members and described current studies on steel corrosion. His talk was followed by an enthusiastic general discussion from the floor.

HAWAII

POSTWAR PROJECTS NOW under construction in Hawaii were discussed at a recent meeting by George Houghtailing, engineer for the Planning Commission of the City and County of Honolulu. Mr. Houghtailing commented particularly on the new arterial highway through Honolulu. In a discussion of the proposed redistricting changes, the membership voted to recommend that the Section be included in the proposed District 15. The principal speaker at another recent meeting was Garner Anthony, Honolulu attorney, who described the proposed new state constitution for Hawaii. Mr. Anthony emphasized the fact that engineers should participate with other groups in drafting the constitution.

ILLINOIS

RECENT ACTIVITIES OF the Illinois Section include participation in the Chicago Technical Conference, held in conjunction with the annual Chicago Production Show. As its contribution to the meeting theme, which was "A Progress Report to the Nation," the Section presented a symposium on the role of the civil engineer in Chicago's progress. Speakers were L. D. Jensen, Chicago consultant, who discussed the development of the skyscraper; H. C. Boardman, of the Chicago Bridge and Iron Co., who described recent advances in the art of fabricating steel plate; and L. D. Gayton, assistant city engineer of Chicago, whose subject was the development of movable bridges. R. I. Randolph, former president of the Chicago Association of Commerce, was chairman of the session, and A. L. R. Sanders technical chairman.

INDIANA

ALTHOUGH HIGHWAY CONSTRUCTION and maintenance costs are practically double those of a few years ago, the revenue for this work has not increased, H. D. Hartman said in an address before a joint meeting with the Indiana Society of Professional Engineers. Other problems currently facing the state highway departments include the greatly increased traffic load and heavier truck loads, Mr. Hartman said. He stressed the fact that sound highway construction requires good engineering. Speaking on the same program, Noble P. Hollister discussed the subject of off-street parking in Indianapolis. He described the plan being developed by the city for municipally owned off-street parking facilities and current methods of studying and analyzing the traffic situation.

INTERMOUNTAIN

RECLAMATION PROJECTS AT present under study in Utah were outlined at a recent meeting of the Intermountain Section by J. W. Funk, of the U.S. Bureau of Reclamation. The discussion following his talk centered about the proposed Utah Central Project and the Colorado River problem. Guests of the Section for the occasion included ASCE Director F. W. Panhorst, who discussed the proposed redistricting of Local Sections. At another recent meeting, the principal speaker was E. S. Fraser, plant superintendent of the Chicago Bridge and Iron Co., who outlined the history of the organization and described its plans for construction of a Salt Lake plant.

IOWA

THE IMPORTANCE OF thorough technical training for an engineering career was stressed by A. P. Boysen, division engineer for the American Bridge Co., Chicago, at a joint meeting of the Section and the Iowa State College Student Chapter. A talk on the work of the Society, given by ASCE Midwest Representative George S. Salter, concluded the technical program.

ITHACA

USE OF THE intrusion method of placing concrete in the maintenance and repair of concrete structures was described by B. D. Keatts, regional vice-president of Intrusion-Prepakt, Inc., of Cleveland, at a joint meeting of the Section and the Cornell University Student Chapter. Kodachrome slides showing the use of the method in the reconstruction of tunnel linings, bridge piers, abutments, wingwalls, dams, and foundations supplemented Mr. Keatts' talk.

KANSAS

A TALK ON the Tacoma Narrows Bridge comprised the technical program at a recent dinner meeting. This was given by John I. Parcel, member of the St. Louis firm of Sverdrup & Parcel.

KANSAS CITY

THE ROLE OF the United States in European recovery was discussed at a recent meeting by Waldo G. Bowman, editor of *Engineering News-Record*. During dinner a report on the proposed redistricting of Sections was given by Ernest E. Howard, former Vice-President of the Society. The principal speaker at another recent meeting was Kenneth A. Spencer, president of the Spencer Chemical Co., of Kansas City, whose subject was "The New Chemical Industry in the Mid-West." The Section passed a resolution congratulating R. E. McDonnell, Section member, upon the fiftieth anniversary of the founding of his firm, the Burns & McDonnell Engineering Co.

At a recent meeting of the Juniors of the Section, Ross Carolla described his experiences while serving as an engineer for the Raymond Concrete Pile Co. on harbor construction in Africa. At present Mr.

Carolla is with the Kansas City firm of Howard, Needles, Tammen & Bergendoff.

KENTUCKY

OHIO'S WATER SUPPLY problem is aggravated by the large population of the state and heavy industrial uses, such as the manufacture of steel and paper products, C. V. Youngquist, chief engineer of the Ohio Water Resources Board, Columbus, told members of the Kentucky Section at a recent meeting. Mr. Youngquist stressed the importance of an adequate water supply to industrial as well as domestic users, and described recent studies on groundwater supply made by the Water Resources Board. ASCE Director D. V. Terrell attended the meeting and spoke briefly on the proposed constitutional amendment to increase Society dues.

LOS ANGELES

TRENDS IN THE planning and design of modern office buildings were discussed at a recent monthly meeting of the Los Angeles Section. The principal speakers were Murray Erick, Los Angeles engineer, and Welton D. Becket, of the Wurdeman-Becket architectural firm, who discussed engineering and architectural features of the General Petroleum and Prudential Western Home Office Buildings now under construction in Los Angeles.

Prior to the regular meeting, the Junior Forum met for a general discussion of the topic, "Is Civil Engineering in Danger of Becoming Socialized?" The discussion was led by Homer Jorgensen and Robert McClellan, members of the Forum.

MARYLAND

FAILURE OF THE joint chiefs of staff to present a unified plan of combat aviation requirements has handicapped the work of the House Subcommittee on Combat Aviation, Congressman Carl Hinshaw, M. ASCE, said in a recent address before the Maryland Section. Mr. Hinshaw, who is chairman of the House Subcommittee, summarized the recent activities of the group and stated that further efforts are being made to adjust combat aviation needs to the annual defense budget. The Section voted to endorse the candidacy of Paul Holland as ASCE Director for District 6.

NORTHEASTERN

THE HISTORY AND present status of the proposed National Science Foundation were discussed at a recent dinner meeting by Boris Bakhmeteff, Honorary Member of the Society and professor of civil engineering at Columbia University. Dr. Bakhmeteff served as chairman of the EJC Panel for promoting the interests of engineers while legislation on the National Science Foundation was pending. ASCE Director Albert Haertlein attended the meeting and discussed the proposed constitutional amendment for an increase in Society dues.

NORTHWESTERN

NEW FORMS FOR steel construction were described at the April 5 meeting by Henry Penn, district engineer for the American Institute of Steel Construction, Chicago. The proposed redistricting of Local Section boundaries was discussed during the business session.

METROPOLITAN

RECENT DEVELOPMENTS IN the design and construction of large timber structures were discussed at the April meeting of the Metropolitan Section by Verne Ketchum, chief engineer of Timber Structures, Inc., Seattle, Wash. Speaking on "Engineering in Wood," before an audience of 250, Mr. Ketchum stressed the use of glued laminated construction in arches.

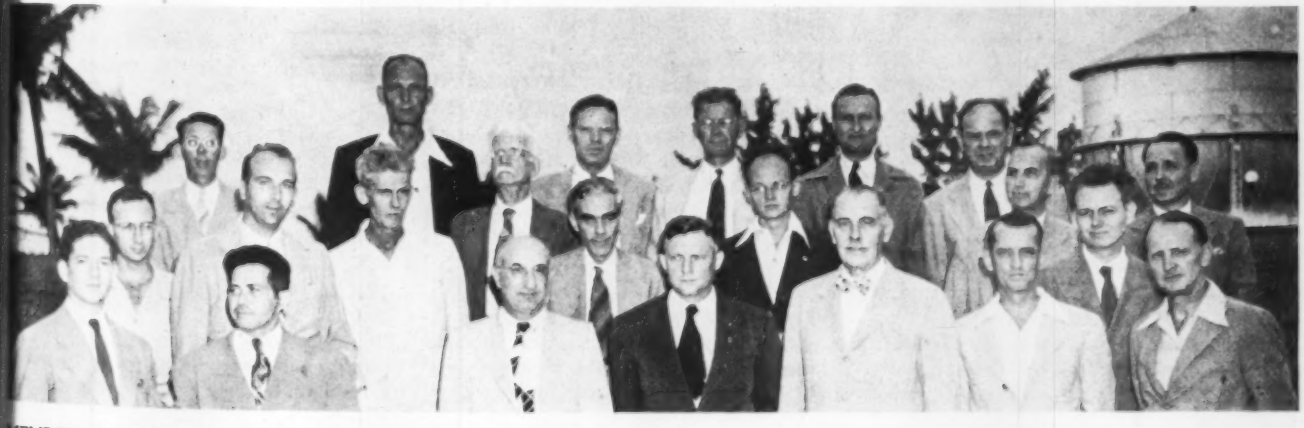
Members of the Junior Branch of the Section recently enjoyed an evening of motion pictures. Included in the program were two General Electric films—one on jet propulsion and the other, entitled "Clean Waters," on the dangers of water pollution—and a Sheffield Co. movie, depicting the process of bringing milk to the city consumer. There was an attendance of about 50.

MID-MISSOURI

FEDERAL AND STATE agencies are cooperating with excellent results in the development of the Missouri River Basin, W. G. Sloan, co-author of the Pick-Sloan Plan for development of the basin, told members of the Section recently. Speaking on "The Problems of the Upper Missouri River in Relation to the Over-all Development of the Basin" at a joint meeting with the Jefferson City Engineers Club, Mr. Sloan brought out the fact that development of irrigation and power has been the major concern in the upper basin in contrast to flood control and water transportation in the lower

MIAMI

INSPECTION OF THE water plant of the West Palm Beach Water Co. and of the Riviera power station of the Florida Power and Light Co. featured the April 3 meeting of the Miami Section. The group was entertained at a noon luncheon by Ralph Reynolds, superintendent of the water company. ASCE Past-President Malcolm Pirnie, of New York, who was a guest of the Section, gave a brief history of the development of the plant, which has a present capacity of 30 mgd. The Riviera power station, a recent installation of the Florida Power and Light Co., contains a single unit of 56,000 hp.



MEMBERS OF MIAMI SECTION and their guests inspect plant of West Palm Beach Water Co. Shown in front row are Edmund Friedman, president of Section (third from left), and ASCE Past-President Malcolm Pirnie, of New York (third from right), who was guest of Section.

basin. He emphasized the fact that these interests will not conflict with each other in the Pick-Sloan plan of development.

NEW MEXICO

FOLLOWING PARTICIPATION IN the technical program of the All-Engineers' Conference, held in Albuquerque on April 2, members of the New Mexico Section held a brief business session. Subjects discussed included the proposed increase in ASCE dues and the desirability of increased Section interest in Student Chapter activities. The Chapter voted to give money prizes in a forthcoming prize paper competition.

OKLAHOMA

PROGRESS MADE IN petroleum engineering was outlined by C. V. Sidwell, professor of petroleum engineering at the Univeristy of Tulsa, at a meeting of the Tulsa Branch of the Oklahoma Section. Tracing the development of petroleum engineering back to 1859, when the first oil well was drilled to a depth of 70 ft, Professor Sidwell stated that present-day wells, which are 250 times as deep as the first one, require materials and engineering methods that were beyond concept prior to the first World War.

OREGON

A TALK ON conditions in Western Europe comprised the technical program at a recent dinner meeting. This was given by Philip H. Parrish, member of the editorial staff of the *Portland Oregonian*. The proposed constitutional amendment to increase Society dues was discussed during the business meeting.

PHILADELPHIA

TRANSFORMATION OF ELECTRONIC energy to production of sound, light, and radio-frequency heat was discussed at a joint meeting of the Section and the Engineers Club of Trenton on April 8. A panel of speakers from the Radio Corporation of America laboratories at Princeton, N.J.—Dr. H. F. Olson, H. W. Leverenz, and George H. Brown—discussed the three major applications of electronic energy. An electronic microscope and other apparatus were demonstrated by J. Hillier.

ST. LOUIS

AIRPORT PLANNING IN metropolitan areas is necessary if difficulties and undue expense in construction of access and facilities are to be avoided, Herbert H. Howell, superintendent of the Airports Branch of the Civil Aeronautics Administration at Kansas City, told members of the Section at a recent luncheon meeting. Speaking on the effect of the National Airport Plan on the St. Louis metropolitan area, Mr. Howell stated that the plan recognizes that the St. Louis area covers parts of two states and comprises several municipalities, thus involving interregional cooperation on airport problems east and west of the Mississippi. The plan indicates, he said, that by 1960 there will be a need for three major, one secondary, and twelve minor airports, and 18 local fields. Former ASCE Director Harry F. Thomson attended the meeting and discussed the proposed redistricting of Section boundaries.

SAN DIEGO

INSPECTION OF A new sugar plant near Brawley, Calif., followed by an evening meeting in El Centro, constituted a recent activity of the Section. The $5,000,000 plant, which will soon be ready for operation, will handle a quarter of the total sugar beet production in the Imperial Valley. Following dinner, a talk on the manufacture of sugar was given by a staff member of the Holly Sugar Corp.

SEATTLE

PROBLEMS INVOLVED IN the engineering and economic administration of Germany were outlined at a recent meeting by Col. William Whipple, executive officer of the North Pacific Division of the Army Corps of Engineers. Colonel Whipple, who has been stationed in Germany, gave a general picture of the European situation. Section guests included Capt. C. F. Ganong, head of the local branch of the Society of American Military Engineers, and ASCE Western Representative Walter E. Jessup, who spoke briefly.

TENNESSEE VALLEY

CHATTANOOGA'S SEWAGE COLLECTION and disposal problems were reviewed by Harry Hendon, of the Birmingham (Ala.) consulting firm of Polk, Powell, and Hendon, at a dinner meeting of the Chattanooga Sub-Section. Mr. Hendon emphasized the difficulty of obtaining any byproduct of commercial value from the treated waste.

The principal speaker at a recent meeting of the Holston Sub-Section was Dr. M. Wadewitz, plant manager of the North American Rayon Corp., Elizabethton, who discussed the viscose process of manufacturing rayon. Samples of pulp, viscose, yarn, fabrics, and spinnerettes were displayed and explained in detail during the talk.

There was a record turnout of members of the Knoxville Sub-Section to hear Clarence T. Jones, of Chattanooga, give an illustrated lecture on astronomy. During the business session, the redistricting plan proposed by the Board of Direction was studied.

TACOMA

KNOWLEDGE OF THE fundamentals of effective public speaking can be an incalculable aid to engineers and others in business and professional conferences, sales talks, and formation of group policy, V. D. Patterson, area manager of the Dale Carnegie Courses in Effective Speaking, said in a recent talk to Section members. Mr. Patterson gave an outline of key words that the speaker can keep in mind to make his speeches concise and interesting. Audience reaction to his talk was very enthusiastic, as several Section members have recently been taking courses in public speaking.

TOLEDO

A DISCUSSION OF panel heating comprised the technical program at a recent meeting. The principal speaker was Charles Hoffman, of the Toledo firm of Peterson, Hoffman & Barber. During the business session, William Dripps, former president of the University of Toledo Student Chapter, outlined the program for the forthcoming Student Chapter Conference to be held at the university.

WISCONSIN

TO CELEBRATE THE twenty-fifth anniversary of the Marquette University Student Chapter, the Wisconsin Section recently held a joint meeting with the Chapter at the university. A special educational and vocational guidance program, consisting of a symposium on "The Young Civil Engineer and His Profession," had been arranged for the occasion. The speakers were C. D. Franks, vice-president for promotion of the Portland Cement Association, Chicago, who discussed engineering from the promotion and sales standpoint; L. J. Selzer, president of a Milwaukee general construction firm, who spoke on construction; L. E. Peterson, Milwaukee consultant, who commented on opportunities in the consulting field; M. O. Withey, dean of the engineering school at the University of Wisconsin, who presented the field of education; and George P. Steinmetz, chief engineer of the Wisconsin Public Service Commission, who covered public employment.

WYOMING

SPEAKING ON THE international situation at a joint meeting with the Cheyenne Engineers Club, Gale McGee, professor of history at the University of Wyoming, pointed out that the present struggle for control of war-torn countries follows a historic pattern and that knowledge of this fact should enable us to view the present situation in proper perspective. We should be firm, he said, in exerting our influence in Europe by means of immediate monetary support backed, if necessary, by armed force.

NEWS BRIEFS

Advance Planning in Public Works Is Needed to Strengthen Our National Economy

ALTHOUGH PRESENT CONSTRUCTION prospects are better than they were a year ago, the volume of construction in percentage of national income falls considerably below that of the two decades prior to the war when it averaged 10.5 percent, according to Ray C. Kirkpatrick, director of labor relations for the Federal Works Agency. In 1947 construction accounted for only about 6 per cent of the national income, and it will probably not exceed that percentage in 1948, Mr. Kirkpatrick stated in an address before a recent meeting of the Louisiana Federation of Labor.

Stating that the advance planning program as provided by the War Mobilization Act of 1944 marks a long step forward, as it has enabled many communities to launch needed projects and, at the same time, is the best kind of insurance against waste and haste, Mr. Kirkpatrick pointed out that, unfortunately, the authority to make these loans ended with the expiration of Title V of that Act on June 30, 1947. Bills that would restore this authority are now pending in Congress, he said.

Outlining some of the functions of the FWA in the construction field, the speaker said that federal aid in highway building dates back to 1916 and passage of the Federal-Aid Road Act. In that year the Bureau of Public Roads (now the Public Roads Administration) began to assist the states in constructing highways, and the present federal-aid highway network is an outgrowth of that early cooperation.

"Such cooperation is much closer and more far-reaching today and recent legislation has included urban highways in the federal-aid program," he continued. "The latter is a wholly new departure in highway legislation. It promises a great deal in the way of urban development and arterial highway construction. Today many cities over the country are tackling their highway and traffic problems in close cooperation with state highway departments and the Public Roads Administration."

Other construction activities of the FWA include the erection of federal buildings. What is now known as the Public Buildings Administration of the agency has been designing and building post offices, federal courthouses, marine hospitals, and many other structures for at least a century, Mr. Kirkpatrick said. "In addition," he pointed out, "this arm of the FWA is the largest real estate holder and carries out the largest housekeeping operation in the world. The maintenance of federally owned buildings is also a huge undertaking.

"The youngest member of the federal works family is the Bureau of Community Facilities," the speaker stated, adding that this organization administered war community facilities and services under the Lanham Act. It also handles the Veterans' Educational Facilities Program, which has provided buildings and equipment for many hard-pressed schools.

Through the Bureau of Community Facilities, the FWA has been active in construction of public works since 1944, when Congressional authorization for planning of needed public works was given, Mr. Kirkpatrick stated. "Title V of the War Mobilization and Reconversion Act authorized the FWA to make repayable advances to the states and their political subdivisions to assist in the detailed planning of needed public works," he said. "This program was entrusted to the Bureau of Community Facilities. As a result of this nation-wide stimulus, plans and blueprints for some 7,300 useful public projects are coming off the drawing boards. When completed, they will represent a total building program to cost about two and one-third billion dollars of non-federal funds."

Debating the question of whether the two and one-third billion dollars spent on state and local projects, under Title V, is "large enough to be a real anchor to windward if private construction should taper off or if the general level of economic activity should swing down," the speaker gave a close-up of what construction means in our complicated economy. "Recently J. W. Follin, Assistant Administrator of the FWA, estimated that construction volume would come to about $13.7 billion in 1948—this a combined estimate of 10 billion dollars for private construction and some 3.7 billion for all public works. Since these figures are in terms of 1947 prices, the total represents a rise of 7 percent in physical volume over the $12.8 billion of new construction put in place in 1947."

Although it is generally agreed that less essential public works should be postponed while housing and other private construction is active, the speaker stated, the present is the time to plan public works against the day when private construction slackens. "If we wait, our program will be 'too little and too late,'" he warned.

In estimating how much of a reserve of completed plans we should have on hand, Mr. Kirkpatrick pointed out that public buildings must be considered apart from highways. "For it is this type of construction—schools, fire stations, hospitals, and other public buildings—that can be expected to take up the slack when building contractors are not busy with private work," he said. "Such a reserve should include thousands of small projects scattered throughout the country.

"Yet on this vital sector of the construction front, the FWA finds that we have less than half the desired volume of public buildings blueprinted," he pointed out, saying, "Our shelf is really half empty. And this is particularly true of state and local projects where there is not even one year's normal building requirements available. And we are losing ground each month as projects included in state and local reserves are put under contract."

Mr. Kirkpatrick concludes that "we need more advanced planning—the kind of planning that legislation now before Congress would encourage—plans that will help our communities and strengthen our national economy."

Continued Improvement Seen for Construction Inventories

BUILDERS SHOULD EXPERIENCE little difficulty in obtaining materials as needed if they are ordered at the beginning of a job, according to a report by the Construction Industry Information Committee based on findings of its economists. Dealers' inventories of almost all building materials have improved greatly, the report shows, and they are expected to increase substantially during the year.

"While materials production has increased 39 percent since 1939," the report states, "the physical volume of new building construction has increased about 15 percent. Some of the excess of materials output over new construction has gone into a greatly expanded volume of maintenance and repair, but the difference is partly due to the gradual rebuilding of inventories by manufacturers, dealers and builders."

The margin between recent and expected production rates and the expected consumption of materials this year promises further improvement of inventories, the report indicates.

Lumber Experts Are Told of Engineering Aids to Industry

IMPROVEMENTS LEADING TO full utilization of forest wealth and lower cost wood products through engineering and scientific treatment were analyzed before some 500 administrative executives and technicians attending the Chicago Production Show recently. Such subjects as chemical conversion of wood waste, mechanical conversion and the manufacture of fiber products, bark removal and bark products, coordination of research, woodworking equipment developments, the elements of dielectric heating and the application of dielectric heating to gluing were among those discussed in prepared papers and open forum sessions.

U.S. Produced 53 Percent of World's Steel in 1947

FIFTY-THREE PERCENT of all the steel produced in the world in 1947 was the output of the United States, where the per capita production was about eight times as large as the per capita output for the entire world, according to a recent analysis by the American Iron and Steel Institute.

Of the world's total production of 159,000,000 tons last year, the United States produced 84,784,000 tons, the analysis shows. Per capita output in this country was 1,180 lb compared with the average for the entire world of 148 lb. Belgium and Luxemburg showed the second highest per capita rate of production, 1,124 lb, while Russia, turning out less than Great Britain, Canada, Sweden, France, and several other countries, had a per capita production of 232 lb. Russia, however, together with Holland and Denmark, produced more steel last year than in their best prewar years.

Atomic Energy Engineering to Be Studied at Oak Ridge Plants

EDUCATION of graduate engineering students in a program designed to develop ability to apply basic principles to the solution of technical problems encountered in industry, with emphasis on engineering aspects of atomic energy, is the purpose of a school being established by the Massachusetts Institute of Technology for its engineering students in the production plants of the Atomic Energy Commission at Oak Ridge, Tenn.

Students will receive their engineering practice training in plants operated by the Carbide and Carbon Chemicals Corp. at Oak Ridge. The program is in accord with the announced policy of the Commission to encourage education and enlargement of both theoretical and practical knowledge relating to atomic energy, and is designed to provide students with a varied plant experience which would better prepare them for responsible engineering positions in the field of atomic energy.

The MIT unit at Oak Ridge will be open to students from any pertinent branch of engineering at the graduate level who have been in residence at the institute at least one term. They must be U.S. citizens, must be cleared by the Commission before being considered for admission, and will live as a group for approximately five months at Oak Ridge. The first group will begin their studies in July, the second in February 1949. Academic credit will be given for the work at Oak Ridge, but since the time spent will be devoted solely to education, there will be no compensation

Arterial Roads to Get N.J. Priority as Defense Step

ADVANCED PRIORITY WILL be given arterial roads through New Jersey municipalities in the next fiscal year program in New Jersey as a contribution to national defense plans. Growing tension in the international situation has revealed the need for adequate arterial routes through cities, in the opinion of the state's highway executives, and the highway department in next year's construction plan will recognize priority for projects of value for normal transportation as well as their utility for national defense.

Active construction operations are now under way in New Jersey for a distance of $8\frac{1}{2}$ miles on Route 4, the state's first parkway, from the Lehigh Valley Railroad in Cranford township, Union County, to N.J. Route 35 at New Brunswick Avenue, near the Edison Bridge, in Middlesex County.

$650 Million in Road Building Equipment Needed This Year

ROAD BUILDING and maintenance equipment worth $650,000,000 will be needed for the 1948 highway program, due to the accumulated deficit of the past few years, according to Charles M. Upham, M. ASCE, engineer-director of the American Road Builders' Association. As part of the program of equipment improvement to keep pace with the postwar highway program, the association will have its first postwar Road Show at Soldier Field, Chicago, July 16–24, at which advances in efficiency of new equipment, designed for the greatest highway construction program in history, will be demonstrated.

Since the end of World War II, Mr. Upham said, equipment manufacturers have made rapid progress in developing new equipment designed to operate more economically and efficiently.

More than 300 manufacturing concerns will have exhibits at the 30-acre Road Show display at Soldier Field. Demonstrations, films and displays will be used to show the latest developments.

The 45th annual convention of the American Road Builders' Association will be held concurrently with the Road Show

Construction Roundup

From the Construction Industry Information Committee—Washington, D.C.

THE BUILDING INDUSTRY has accomplished a tremendous production job in the last two years, in housing and otherwise.

Contrary to "talk," it has produced the great bulk of the new houses at prices which families with $1,000 to $5,000 income can afford. At the same time the industry has carried out an unprecedented volume of maintenance and repair work on existing houses and other structures, which has meant substantial improvement in the housing supply.

And despite the emphasis on housing other types of construction have gone steadily forward, with the result that the physical volume of all new construction has more than doubled the wartime low of 194[illegible] and has even topped 1939.

In addition to accomplishments in the housing field, the large amount of industrial and other construction that has gone ahead rounds out a good picture of accomplishment for the industry. An outstanding record has been made in construction of new industrial plants needed to meet unprecedented postwar demands for goods. As early as 1946, the physical volume of new industrial building had climbed to within 2 percent of the all-time high attained in 1939 and was more than 700 percent above the wartime low reached in 1943.

The response of the building industry to the demands put upon it and the fact that it was able to achieve such volume in all types of construction in the second full year after the end of hostilities is a tribute to all elements in the industry.

TEN-YEAR SERVICE RECORD established by double-track, ballast-type bridge on Pennsylvania Railroad's heavily traveled main line out of Washington, D.C., has resulted in adoption of same design for additional single-track span. Use of wrought iron deck plates of all-welded construction in design ensures watertight base for roadbed ballast, eliminating need for regular inspection and maintenance. Plates also provide protection against corrosion for structural beams to which they are welded.

Air Indicator Aids Concrete Paving Operations

ESSURE-TYPE AIR INDICATOR, shown use on concrete paving project, enables urate determinations of air content of hly mixed air-entrained concrete to be de under field conditions in 7 to 8 min. ly demonstrations of method will be fea- of Portland Cement Association's ibit at 45th annual Road Show in Chicago, 16-24.

itish Show New Materials, Methods at Industries Fair

REPRESENTATIVE selections of new and ient building aids are being displayed 250 firms now exhibiting at the British ustries Fair building section in Birming- n, England. The fair, which opened May will continue to May 14. It embraces lays showing Britain's part as a "forc- ground" during World War II for new ding equipment, materials and tech- ues. Plans for construction of homes, ools, hospitals, factories and public dings, are included. Powerful and dy equipment for land clearance and preparation are being shown, together a new mechanical shovel, concrete- ing and block-making machinery, de- ed especially for export.

o Requirements Cited for Concrete Aggregates

GGREGATE FOR EITHER heat-resistant or actory concrete must meet two require- ts, according to S. B. MacDonald, field neer, Universal Atlas Cement Co., who e on "Refractory and Heat-Resistant crete" before the recent annual meeting e Canadian Ceramic Society at Niagara s, Ont. First, the aggregate must not ntegrate under heat; second, it must undergo sudden or excessive volume ge which will disrupt the concrete.

or refractory concrete, he said, the ag- ate should be a material which will re- t high temperature with the cement and hydration products to form a fired bond. Crushed clay-firebrick is the most widely used aggregate for refractory concrete. Development of concrete for high-temperature service, the speaker said, really began when cement of the calcium-aluminate type was tried as a binder. The ability of heat-resistant concrete to stand up under soaking heat depends on the maintenance of a hydraulic bond—the element of strength in ordinary structural concrete. With calcium-aluminate cement, an effective part of the hydraulic bond is retained—not the full strength of the cold concrete, but sufficient strength to serve the usual structural purposes, Mr. MacDonald said.

Navy Seeking Employees for California Research Units

EXAMINATIONS IN CIVIL and virtually all other branches of engineering are open to fill vacancies at three naval research centers in California, according to an announcement by the Navy Department Joint Board of U.S. Civil Service Examiners. Examinations also are open for the following professional positions: chemist, mathematician, metallurgist, meteorologist, physicist, statistician, scientific research administrator, and scientific staff assistant. Openings are at the Naval Ordnance Test Station, China Lake; the Navy Electronics Laboratory, San Diego; and the Naval Air Missile Test Center at Point Mugu on the California coast 60 miles north of Los Angeles.

Professional positions are in the career service of the federal government under Civil Service laws, with attendant benefits. Based on level of ability, knowledge and experience, salaries range from $3,397 to $9,975 annually, the entrance salary rates for professional grades P-2 through P-8. Further information may be obtained from the Navy Department Joint Board of U.S. Civil Service Examiners, 1040 East Green Street, Pasadena 1, Calif.

Portland Cement Association Plans Two New Laboratories

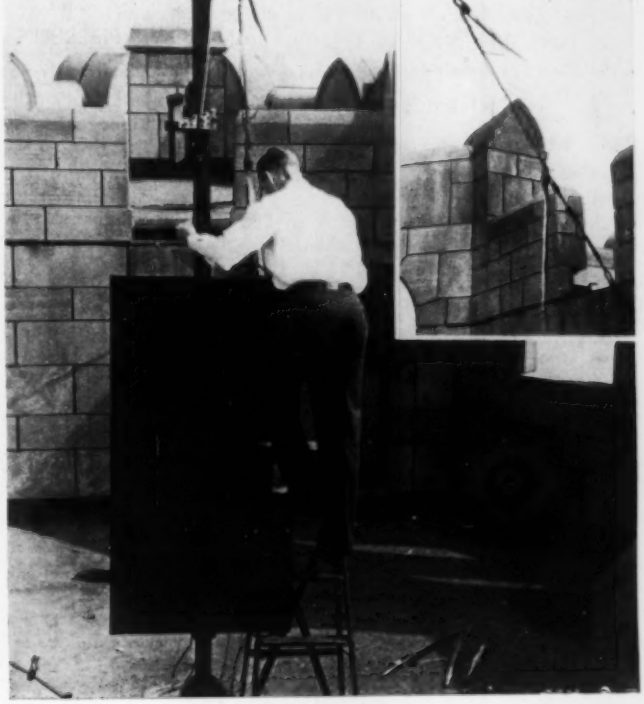
A RESEARCH LABORATORY comprising two concrete buildings of modern design with a total floor area of approximately 98,000 sq ft will be built by the Portland Cement Association on a 15-acre tract in Skokie, Ill., 15 miles north of Chicago, according to an announcement by Frank T. Sheets, M. ASCE, president of the association. Bids are now being received for the construction work. The main building, two and three stories high, will be connected by a covered walkway to an auxiliary one-story structure.

More than 25 specialized laboratories, moist curing rooms, fog rooms, low temperature, freezing and thawing rooms are included in the plans. All will be equipped with the most modern scientific apparatus, including a 1,000,000-lb compression testing machine. There will also be an auditorium, technical library, reading room and a cafeteria.

To facilitate research into the durability of concrete structures under all climatic conditions, the steaming heat of African jungles, desert dryness and Arctic cold will be simulated in the laboratories.

The laboratory's reinforced concrete frame and architectural concrete exterior was designed by the Chicago architectural firm of Carr & Wright to give minimum maintenance cost, maximum flexibility for first and future installations and for fine appearance both inside and outside.

Super Lightning Bolt Recorded by Magnetic Device



LIGHTNING TRAPS ATOP University of Pittsburgh's Cathedral of Learning are inspected after registering record lightning bolt of 345,000 amp. Super-bolt was trapped and recorded on special instruments, consisting of magnetic device and photo recorder, installed by Westinghouse Electric Corp. as part of long-range research program to improve design of protective equipment for homes, industrial buildings and power houses. Wooden spar lying on building roof was completely shattered by lightning and big splinters were gouged from two other spars. Inset (upper right) shows close-up of shattered spar.

Industry Progress Reported by Construction Committee

CONSTRUCTION PROGRESS IN cost reduction, time consumption, volume and increased skilled manpower will be detailed for the general public through an extensive information program, including a series of economic studies, under auspices of the Construction Industry Information Committee.

First of the studies, entitled "Who Can Afford Our New Housing?" has just been distributed. Pamphlets, speeches and newspaper stories also will tell of the industry's progress. Five major achievements attained by the construction industry are amplified in the current economic study. These include information indicating that: the industry has broken all past records in rapidity of construction, particularly in home building; the physical volume of construction since the wartime low year of 1944 has more than doubled, exceeding the volume of 1939, base prewar year used by most statisticians as a measuring point; skilled manpower has been sizably increased, with 115,000 apprentices reported in training by the Department of Labor; building time has been drastically shortened in both light and heavy construction, with home building time now reported down to 4.5 months for a house, compared with 10 to 12 months late in 1945; as a cost reduction step the construction industry has entered the field of standardizing and coordinating materials in the program of modular coordination and in the industry engineered housing program.

In contrast to the gloomy materials picture of two years ago, the committee reports that production of most building materials made spectacular gains from 1945 through 1947. Production recovery following World War I took five years after 1918 to increase output more than 50 percent, while it required only two years after 1945 to raise production that amount, the committee indicates.

An unprecedented volume of maintenance and repair work on homes and other structures has been carried out during the past 12 months, the committee's reports show. This is in addition to producing new housing at a near-record rate.

Considerably more than half as much was spent on maintenance and repair as on all new construction in 1947, according to the reports, which cite the Department of Commerce estimate of maintenance and repair volume for 1947 as seven billion dollars, compared with 12.8 billion for total new construction. This repair and maintenance activity broke all records, the prewar peak having been 3.9 billion dollars in 1941, and the 1946 volume 5.6 billion.

Western Construction Projects Announced by Reclamation Bureau

WORK IN PROSPECT on several Western and Pacific Coast construction projects is listed under the head of "Bid Calls Expected This Month," in the Bureau of Reclamation's *Advance Construction Bulletin*, dated April 1. While the bulletin states that information published is subject to revision, data given will provide an indication of the size, nature, and location of proposed projects.

EARTHFILL DAM

Missouri Basin Project, Kansas

Location: On the Smoky Hill River near Ellis, Kans.

Work: Construction of Cedar Bluff Dam, an earthfill structure approximately 136 ft high and 12,570 ft long.

Excavation	2,420,000 cu yd
Earthfill	8,000,000 cu yd
Concrete	47,000 cu yd
Furnishing and placing reinforcing steel	4,300,000 lb
Rockfill	3,000,000 cu yd
Riprap	220,000 cu yd
Sand and gravel fill	500,000 cu yd
Furnishing and handling cement	73,000 bbl
Time allowed for completion:	1,300 days

LATERALS

Roza Division, Yakima Project, Washington

Location: Vicinity of Sunnyside, Wash.

Work: Construction of earthwork, pipelines, and structures for lateral distribution system, Pumping Areas 9A, 10, and 12A.

Excavation	31,000 cu yd
Concrete pipe	40,000 ft
Time Allowed for Completion:	270 days

PIPELINES and STRUCTURES

Coachella Division, All-American Canal, California

Location: Near Indio and Coachella, Calif.

Work: Construction of concrete pipelines and structures for Units 2, 3, and 4, Coachella Valley distribution system.

Furnishing and placing concrete pipe from 10 to 72 in. in diameter	120 miles
Pipe trench excavation	412,000 cu yd
Concrete in structures	1,250 cu yd
Time Allowed for Completion:	550 days

CANAL AND LATERALS

Missouri Basin Project, Montana

Location: Between Glendive and Sidney, Mont.

Work: Construction of approximately 8 miles of main canal and laterals on the Savage unit (Yellowstone Pumping).

Excavation	137,500 cu yd
Furnishing and placing 18- to 42-in. diameter concrete pipe	3,000 ft
Concrete	810 cu yd
Furnishing and placing reinforcing steel	60,000 lb
Time Allowed for Completion:	400 days

LATERALS

Roza Division, Yakima Project, Washington

Location: Vicinity of Zillah, Wash.

Work: Construction of earthwork, pipelines, and structures for lateral distribution system, Pumping Areas 2, 5, 6, and 7.

Excavation	60,600 cu yd
Concrete pipe	58,700 ft
Time Allowed for Completion:	240 days

SUBSTATION

Fort Peck Power Project, Montana

Location: Wolf Point, Mont.

Work: Designing, constructing, and furnishing equipment for Wolf Point substation with capacity of 7,500 kva.

Time Allowed for Completion: 550 days

SUBSTATION

Davis Dam Project, Arizona-Nevada

Location: Cochise, Ariz.

Work: Constructing and furnishing equipment for Cochise substation with capacity of 10,000 kva.

Time Allowed for Completion: 850 days

CHANNEL IMPROVEMENTS

Klamath Project, Oregon-California

Location: About 10 miles southeast of Klamath Falls, Ore.

Work: Construction of improvements of approximately 7 miles of the Lost River Channel through the Poe Valley.

Excavation	535,000 cu yd
Furnishing and erecting timber	17,500 fbm
Clearing right-of-way	60 acres
Furnishing and driving timber piles	640 lin ft
Time Allowed for Completion:	300 days

DIVERSION CHANNEL IMPROVEMENTS

Klamath Project, Oregon-California

Location: Vicinity of Klamath Falls, Ore.

Work: Construction of improvements for Lost River Diversion Channel.

Excavation	1,050,000 cu yd
Concrete	2,000 cu yd
Furnishing and erecting timber	340,000 bd ft
Time Allowed for Completion:	550 days

ASCE Men Among Officers of New York Moles Society

FOUR ASCE MEMBERS are among new officers and trustees elected by The Moles, New York society of tunnel and heavy construction men, at their recent annual meeting in New York City. They include Vice-President Carlton S. Proctor, first vice-president; Ralph W. Atwater, reelected treasurer; Harold W. Richardson and Carl L. Swenson, trustees for three-year terms.

Richard Steers, Jr., New York City contractor, has been elected president.

Chi Epsilon Fraternity Honors Two Prominent Engineers

TWO DISTINGUISHED ENGINEERS—Julian Hinds, member of the ASCE Board of Direction, and Maj. Gen. Lewis Andrew Pick were elected to honorary membership by Chi Epsilon, national honorary civil engineering fraternity, at its recent conclave at Purdue University, attended by six members of the fraternity's supreme council and 38 delegates from 19 active chapters.

Mr. Hinds, general manager and chief engineer of the Metropolitan Water District of Southern California, has been with the water project since its inception in 1928, serving first as designing engineer and later as chief designing engineer in charge of final specifications for numerous reservoirs, five major pumping plants and more than 200 miles of waterways. He has also done hydraulic work for the Republic of Mexico and the Bureau of Reclamation. Early in his career he did engineering work on several railroads along the Pacific Coast. He is the author of numerous articles, several published in CIVIL ENGINEERING and the ASCE TRANSACTIONS. For his paper, "Channel Spillways," in the 1926 TRANSACTIONS, he was awarded the Norman Medal.

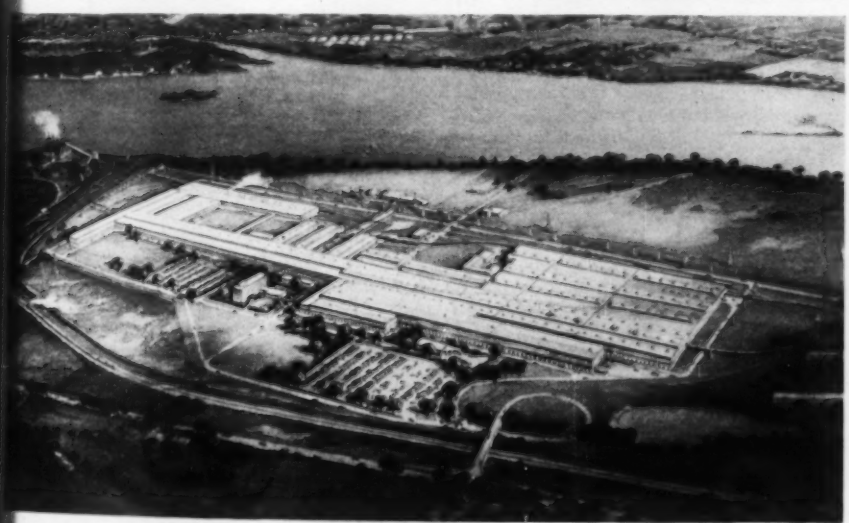
General Pick, who gained fame as the builder of the Ledo Road during World War II, recently supervised one billion dollars worth of military construction in connection with his present assignment. For his work on the Ledo Road, much of it through virgin jungle and mountains, General Pick was awarded the Distinguished Service Medal and the Chinese Order of the Banner and Cloud. He is now serving as division engineer of the Missouri River Division of the Army Corps of Engineers and is co-author of the Pick-Sloan Plan, a comprehensive program for over-all control and utilization of the full water resources of the Missouri Basin (CIVIL ENGINEERING, November 1947, p. 20).

U.S. Health Service Needs Junior Sanitary Engineers

ANNOUNCEMENT IS MADE by the U.S. Public Health Service of a competitive examination to be held in June for appointments in the regular corps in the grade of junior assistant sanitary engineer. This examination will be held concurrently with examinations for assistant and senior assistant sanitary engineer, notice of which appeared on page 61 of the April issue of CIVIL ENGINEERING. Appointments in the grade of junior assistant carry the rank equivalent to second lieutenant.

Assignments include general sanitary engineering, industrial hygiene, malaria and typhus control, milk and food sanitation and research. Entrance pay for the junior assistant grade, with dependents, is $3,391 a year. Promotions are at intervals up to and including the grade of senior sanitary engineer with promotion above that grade by selection. Retirement pay after 30 years' service or at the age of 64 is $4,950. Medical care, disability retirement and annual leave provisions are comparable with those in other branches of government service.

Applicants must be citizens of the United States, at least 18 years of age, and have a degree in one of the several branches of engineering from a school of recognized standing. Application forms and additional information may be obtained from the Surgeon General, U.S. Public Health Service, Washington 25, D.C. Applications must be received prior to June 1.



MORE THAN 6,250,000 LB OF ALUMINUM is going into construction of nearly completed Davenport, Iowa, sheet and plate rolling mill of Aluminum Company of America. Plant, extending nearly mile along banks of Mississippi River, is basically all-aluminum project with exception of 25,000 tons of structural steel framework. Aluminum is used only where it has definite advantages over other metals in weight, cost, physical properties, ease of erection or maintenance. Use of nearly 1,000,000 lb of aluminum cable, bus conductors and conduit has resulted in considerable savings in cost. Included in Davenport project are 112 aluminum precision-built homes being erected near plant for sale to employees.

Portland Area Has Openings for Engineers and Draftsmen

VACANCIES NOW EXIST in the Portland, Ore., district of the Army Corps of Engineers in both the drafting and professional divisions. Civil, cartographic and structural draftsmen and engineering computing draftsmen are needed at salaries ranging from $2,644 to $3,021. Engineers for the planning and design sections are needed in these groups: civil, materials, electrical, soils, structural, architectural, and hydraulic. Entrance salaries in this group range from $3,397 to $4,149.

Western Engineers Society Occupies New Headquarters

ESTABLISHMENT OF A research center where engineering organizations may gather, was announced recently by the Western Society of Engineers. The 79-year-old organization has taken the lead in providing an engineering and scientific center which other organizations of similar interests and professional standards will be invited to share.

About $100,000 is being spent in renovating and equipping the center, which when finished will include meeting rooms, offices, lounges and dining facilities. The center will occupy three floors of the Taylor Building at 84 East Randolph Street.

ASTM Committee Program Attracts Large Attendance

NUMEROUS NEW SPECIFICATIONS and test methods were reported at the 298 meetings of American Society for Testing Materials committees and subgroups during their committee week sessions recently in Washington, D.C.

The Society's week-long annual meeting will open June 21 in Detroit. There, many of the actions covered at recent meetings will be analyzed in detail, following letter balloting, in committee reports. Attendance at recent committee meetings in Washington was approximately 1,100 persons.

New York State Schedules Civil Service Examinations

SEVERAL CIVIL ENGINEERING positions are announced by the New York State Civil Service Commission, with applications to be filed up to May 24, 1948. These include Assistant Civil Engineer (Design) in the Department of Public Works, Albany; Assistant Civil Engineer in various district offices of the Department of Public Works and in the Albany Department of Conservation; and Senior Railroad Engineer in the Department of Public Service, Albany. Entrance salary for Assistant Civil Engineer is $4,242, and for Senior Railroad Engineer $5,232.

Examinations are scheduled for June 19. Application forms and detailed information may be obtained from the State Department of Civil Service, State Office Building, Albany, N.Y., or Room 2301, 270 Broadway, New York City 7.

R. Robinson Rowe, M. ASCE

AT THE MAY meeting of the Engineers Club, the Professor had to wait for a lull in the spirited discussion of reapportionment. A wide river divided the newer West Side from the conservative East Side, but defense projects and a fine climate had lured so many to the West Side that the Club's districts were out of balance. "It's all wrong and getting worse," said Cal. "The West Side with 40 percent of the membership is represented by only 32 percent of the directors and 31 percent of the Board!" "And by only 25 percent on the Zoning Committee," echoed Tex. "We should have three more directors and another vice-president," hollered Wes.

N. G. Neare

"A fine setup for a problem in integers," interrupted Professor Neare, "but the best solution is to holler louder in the right place at the right time. Now let's hear Guest Professor Budd diagnose Frisco's blizzard."

"All I asked was when it started," recalled Professor Budd, "from the fact that a second plow starting 3 hours behind the first caught it in 4 hours."

"An annoying anachronism," said Joe Kerr. "If at 5 p.m. snow had been falling x hours, Plow A removed in 7 hours the accumulation in an average period of $x + 3.5$ hours, and Plow B removed in 4 hours the accumulation on the same stretch in an average 1.5 hours. Equating their hourly capacities,

$$\frac{x + 3.5}{7} = \frac{1.5}{4}$$

or $x = -0.875$, which means that the blizzard started 0.875 hour *after* Plow A started. In that period, either the snow fell up or the plow ran backwards."

"Or a sluggard's paradox," guessed Cal Klater. "Joe knows that the speed of each snowplow must vary inversely with the depth of the snow so that neither plow could reach the halfway point at half time, but he was too lazy to set up the differential equations. This can be avoided by using Wolpwon's formula (CIVIL ENGINEERING, Vol. 18, p. 326):

$$\log \frac{f - s}{a - s} = \frac{b - a}{a - s} \quad . \quad . \quad . \quad . \quad (1)$$

in which all letters are relative times: s, when snow started; a and b, when Plows A and B started; and f, the finish. Here,

$$\log \frac{12 - s}{5 - s} = \frac{8 - 5}{5 - s} \quad . \quad . \quad . \quad (2)$$

and $s = 3.0112022 = 3{:}00{:}40$ p.m. The only thing that worried me was that Plow B plowed into Plow A at infinite velocity!"

"We found that out, Cal, and ordered two new plows with tail-lights and proximity fuses. Anything to add, Noah?"

"I could add a sequel, Budd. The solution of (2) by Newton's method, letting $5 - s = x$, is a nice exercise. Also, Plow B decelerates until 9:37:29 p.m. $= s + \frac{2}{e}(f - s)$, when its location and minimum speed are expressible in simple terms. But for those who abhor the thot of blizzards in May, Guest Professor Justin Case has a teaser that uses another kind of chains.

"At least for the neophytes, Noah. Years ago I was asked to divide a rectangular parcel in two by running the diagonal. Much to my surprise, all dimensions were in exact feet, the rectangle was one foot longer than it was wide and the perimeter of each half was in even chains. How large was the rectangle? If that's too easy for Cal Klater, let him use miles instead of chains."

[*Cal Klaters were: Paul Seide, Richard Jenney, Neare Lee Wright II (Allyn P. Bursley), John L. Nagle, R. E. Phillips, E. A. Holt, O'Kay (Otto H. S. Koch) and the anonymous A. Nuther Nutt. Professor Budd is Charles T. Leddon, and Professor Case is Life Member Homer J. Gault.*]

USE OF COLOR has been introduced in Cooper Union's department of civil engineering materials testing laboratory classes as a means of increasing safety and as a visual teaching aid. Ivory white is used on all interior surfaces that should reflect light onto moving parts; handles and wheels used by operators are yellow; electrical connections are red orange, with deep green used as a neutral and restful background color for all materials testing machines.

SCHOLASTIC AVERAGES OF both fraternity and non-fraternity groups at Rensselaer Polytechnic Institute are higher than in prewar years, although for the first time the all-student average has exceeded the all-fraternity average, according to a recent announcement from the institute. Out of 20 fraternities, 6 topped the all-student average, 3 equalled it, and 11 fell below. The fact that many of the students are veterans with wives and families to look after was given as chief reason for the serious attention to studies and resulting high scholastic standard.

A SPECIALIZED TYPE of calculating machine which may shortly be able to compute the geological age of the earth by exact methods has been developed at Columbia University's school of engineering. It is known as a "heat and mass flow analyzer laboratory." The device already has helped industry remove the element of guesswork from problems relating to "heat flow." Equipment in the laboratory, which was originally established in 1940–1941, has just been rebuilt and its facilities greatly increased. Applying the time-scale technique, it would be possible to "condense" the probable millions of years which were required for the earth crust to solidify into a few hours in the laboratory, according to directors. The analyzer's principle of operation is based on the "electric analogy" method, which means that flow of heat is measured in the same way as electric current. Samples of material to be tested do not have to be used directly; all of the information that is required are the thermal properties of the material involved and their size and shape.

ESTABLISHED TO RENDER a research and engineering service to industry, the Armour Research Foundation of Illinois Institute of Technology, Chicago, has increased its gross volume in research business from $45,000, eleven years ago when it was organized, to $2,500,000 last year. This development is cited in "Partners in Research," the Foundation's eleventh annual report. It indicates a 34.6 percent increase over the year 1945–1946, its greatest increase in annual gross research volume.

RESEARCH BUDGETS AT technical institutions over the country run into six figures, an analysis for 1947–1948 by the engineering section of the Association of Land-Grant Colleges and Universities indicates. Purdue University, with a total research budget of $957,468 and a staff of 32 full-time and 216 part-time research workers, ranks first. Georgia School of Technology, with a budget of $493,000, and 72 full-time and 86 part-time researchers, is second. Pennsylvania State College places third with a research budget of $453,007. School funds appropriated by the institutions' governing boards, industrial and governmental gifts are used to finance research programs.

Yale Offers Fellowships in Traffic Engineering

TEN FELLOWSHIPS IN traffic engineering for the 1948–1949 academic year are available at Yale University, according to an announcement made recently by the Bureau of Highway Traffic at the university. The fellowships amount to $1,400 each and provide a full academic year of graduate study. Nine of the awards are made possible through a grant from the Automotive Safety Foundation and one is a memorial established by the American Transit Association.

Applicants must have a degree in engineering from an accredited college, be residents of the continental United States and should have practical experience in city or highway engineering work. Closing date for applications is June 15.

Lower Excavation Costs

YOU CAN COUNT ON minimum excavation costs with Transite* Sewer Pipe because Transite has an exceptionally high flow capacity (n=.010). This often permits the use of flatter grades and shallower trenches. This is a particularly important advantage where rock excavation is involved or where the pipe must be laid at or below the ground water line.

As an alternate economy, designers often take advantage of Transite's high flow capacity by specifying smaller diameter pipe.

Transite Offers Other Economies, Too. Right from the start, this pipe helps you cut sewage disposal costs. Transite's long 13-foot lengths and light weight mean lower handling costs. And fewer joints to assemble in the finished line result in faster, more economical installation.

Transite Reduces Treatment Costs. As a further economy, tight sleeve-type joints guard effectively against infiltration . . . reduce the load on the treatment plant. Thus, treatment costs are kept low . . . and plant capacity can be conserved for the increased loads incident to future community growth.

Transite Cuts Maintenance Costs. Made of asbestos and cement combined into a homogeneous material of great stability, Transite Sewer Pipe is corrosion-resistant both inside and outside. Tight joints safeguard against root trouble. And every Transite length is factory-tested for strength and uniformity. This adds up to low annual maintenance costs through the years.

Get All The Facts About Transite. If you are seeking ways to lower sewage disposal costs, you'll be interested in the many economies Transite Sewer Pipe can offer you. Send for free brochure containing further engineering data. Address Johns-Manville, Box 290, New York 16, N. Y.

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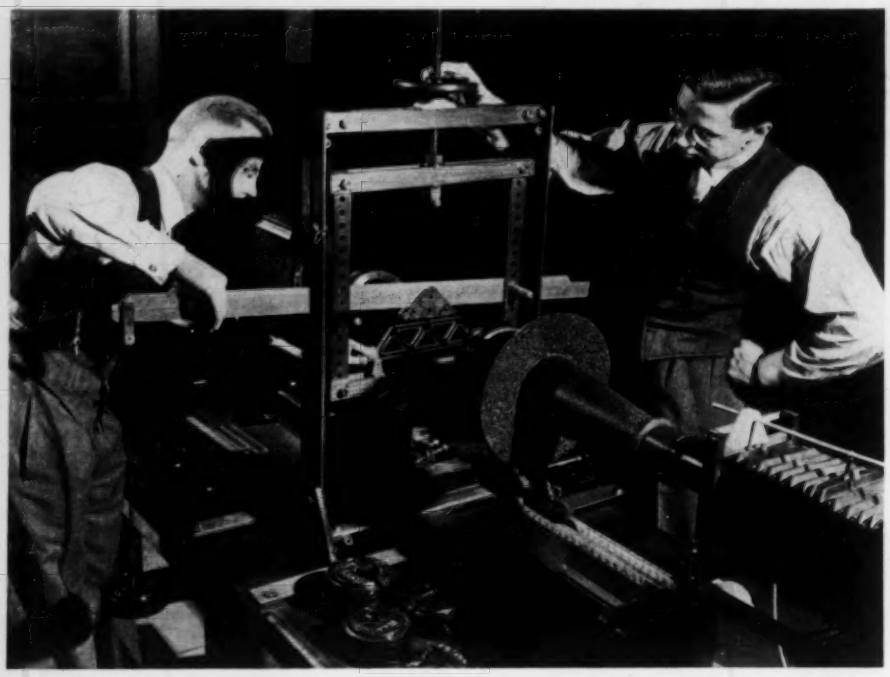
Transite Sewer Pipe

Plastic Truss Model Tested in N.Y.U. Laboratory



PHOTOELASTIC MODEL OF BRIDGE TRUSS is tested in laboratory in New York University College of Engineering. Shown adjusting building frame is Harold Wessman, M. ASCE, chairman of civil engineering department (left) and Student Chapter member Henry Fischer. Operator at left manipulates loading arm, which applies force to plastic truss model shown in center of photograph. Polarized light passes through truss, and camera records color pattern from which stresses in truss members are calculated.

Meetings and Conferences

American Society for Engineering Education. The United States Naval Postgraduate School will be host to the spring meeting of the ASEE, to be held at Annapolis, Md., on May 8. Interesting programs are planned for both men and women.

American Society of Refrigerating Engineers. Nine technical papers on as many fields of refrigeration will be presented at the 35th spring meeting of the American Society of Refrigerating Engineers, to be held at Swampscott, Mass., May 31–June 2. Headquarters for the meeting will be the New Ocean House.

Engineering Progress Show. Presented by junior members of the Engineers' Club of Philadelphia and the Franklin Institute of Pennsylvania, this second annual Engineering Progress Show will be held at Franklin Institute, Philadelphia, May 11 to 16. There will be exhibits of the latest advances in engineering, scientific and industrial fields, together with addresses by nationally known engineers.

Florida Highway Conference. The second annual Florida Highway Conference will be held in Gainesville, May 31–June 1. It will be built around the general theme of interagency cooperation in the overall highway and street program, with particular emphasis on the federal-aid program. The conference is sponsored by the civil engineering section of the Florida Engineering and Industrial Experiment Station, in cooperation with various state agencies.

Fourth International Congress on Tropical Medicine and Malaria. Sponsored by the U.S. government through the Department of State, the Fourth International Congress on Tropical Medicine and Malaria will be conducted in Washington, D. C., May 10–18. Numerous federal agencies and scientific societies will be cooperating sponsors. Meetings will be held in the U.S. Departmental Auditorium, and hotel headquarters will be at the Willard, Washington and Raleigh hotels.

North Carolina Water Works Operators' School. This year the school will be conducted by the Institute of Government, Chapel Hill, N.C., in cooperation with the school of public health of the University of North Carolina at Chapel Hill, June 7–11. Sponsors of the school are the North Carolina Water Works Operators' Association and the North Carolina Section of the American Water Works Association.

Society for Experimental Stress Analysis. The annual meeting of the Society for Experimental Stress Analysis will be held at the Roosevelt Hotel, Pittsburgh, Pa., May 27–29.

Wool Gatherings by WOOLLEY

SURVEYS OF SEDIMENTATION in 20 of the 24 existing reservoirs with 13,000 square miles of drainage area in the Sacramento-San Joaquin Drainage Basins, Calif., show that capacity losses from sedimentation during the first 50 years after construction will range from 0.3 percent to 11.3 percent and that the reservoirs will retain at least 50 percent of their capacity from a minimum of 200 years to a maximum of 8,700 years.

RAPID DEPLETION OF high-grade iron ores in Minnesota focuses increasing attention on deposits in Labrador, Newfoundland and upper New York State.

THE FEDERAL BUDGET for power and allied construction for fiscal year 1949 (more than $1,287,000,000) totals more than 50 percent above appropriations granted in fiscal year 1948.

PRACTICALLY ALL OF the burden of the 32,000,000,000-kwhr increase of electrical energy output of 1947 over 1946 was carried by steam power plants.

BRITAIN IS TO spend more than $400,000,000 this year on scientific research.

AT LEAST 7,000,000 TONS OF scrap iron and steel are virtually going to waste in Japan.

A DEVICE THAT rapidly shakes loose cargoes frozen in freight cars, such as coal and ores, is now available.

THE EXHAUSTION OF underground waters by concentration of industries depending on such supplies is having marked repercussions on the industrial growth and future development in many sections.

ABOUT 334 B.C. ARISTOTLE ran a school that specialized in mathematics, political philosophy, biology and natural sciences. Its field men comprised a thousand men collecting floral and faunal specimens. An expedition was sent to explore the sources of the Nile.

DIESEL LOCOMOTIVES are to be built for the first time in Canada.

MEXICO HAS A program designed to increase its oil production and exploration.

IN 1934 THE UNITED STATES was consuming 2,800,000 bbl of oil a day—by 1947 the daily average was 5,900,000 bbl.

GENERAL ELECTRIC COMPANY has developed an X-ray gage for measuring continuously and automatically the thickness of a moving strip of red-hot steel without touching it.

UTICA, NEW YORK, laid its first 6-in. cast iron pipe 99 years ago—98 percent of all cast iron pipe of that size ever laid is reported to be still in service.

ONE OF THE earliest installations for the reclamation of sanitary sewage for industrial use is at Grand Canyon, Ariz., where water from springs costs about $2.00 per thousand gallons and water hauled in railroad tank cars about $3.00 per gallon

POWER INCOME FROM Bureau of Reclamation projects will amortize about half of the total construction cost for 72 projects.

New All-Welded Studding Cuts Construction Costs $16,000

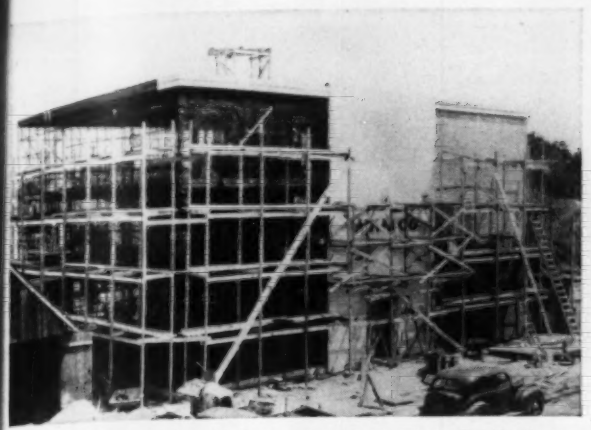


Fig. 1. The new WKM Valve Co. three-story office building. The Matthews Construction Co. and the Brown Construction Co., contractors.

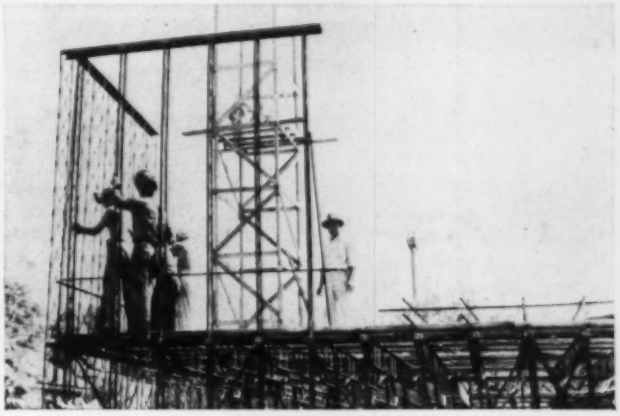


Fig. 3. Second floor panel section being held in place for tack welding.

By Richard P. Matthews
The Matthews Construction Co.
Houston, Texas

A REDUCTION in the construction time of a three-story office building from an estimated seven weeks to three weeks has been accomplished through a new development using prefabricated sectional panels of steel studding. With conventional methods of construction, this building framework would have cost $2.65 per square foot. With our prefabricated method the cost was $1.07 per square foot, which meant an overall saving to the builder of approximately $16,000. Erected without the use of scaffolding, the new arc welded three-story office building of the WKM Valve Co. at Houston, Texas, is fireproof, shrinkproof and free from warpage (Fig. 1).

The office building when completed will be windowless and will be finished with a stucco exterior and a plaster and veneer interior. The panel-type construction has an additional advantage to the builder because of the ease in which plumbing, wiring and insulation can be installed.

The on-the-ground method developed by our company for prefabricating the sectional panels makes use of light weight, lattice web, single piece Bethlehem stretched I beam studs of $\frac{1}{8}$" minimum steel thickness, having a $1\frac{1}{4}$" flange, and cut to specified length. The studs, when braced, support a safe load of 6700 pounds.

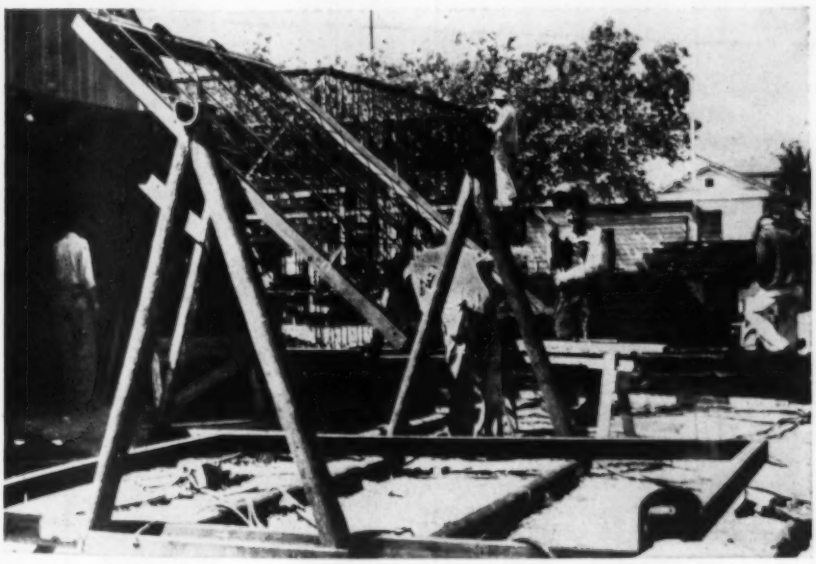


Fig. 2. On-the-ground prefabrication of ten-foot panel sections.

Two assembly jigs, welded from pipe and angle iron, hold the ten-foot panel assemblies and are made to swing to allow downhand welding for the welder's convenience (Fig. 2). In building up the studding panel, the channel girth is held in place with "C" clamps and the vertical studding welded first to the channel girth. The cross bracing is then welded into place and the panel removed from the jig ready for assembly onto the building framework.

The sectional panels for the first floor have a girth welded both top and bottom. The second and third floor panels have a panel girth at the top only and also have additional angle braces to keep the panel unit in square for later assembly to the building framework.

The prefabricated panels can be carried easily by four men who also hold the panels in place while the panels are being tack welded into their position on the building framework. (See Fig. 3). Although no scaffolding is needed in the assembly of the building framework, a jig pole is used to hoist the panel sections into place on the third floor level. The total erection time on the building framework is 21 days including all set-up preparation and using Lincoln 200 and 300 ampere "Shield-Arc" Welders with "Fleetweld 5" and "Fleetweld 7" electrodes.

The above is published by LINCOLN ELECTRIC in the interests of progress. Studies in Structural Arc Welding available to architects and engineers. Write The Lincoln Electric Company, Dept. 153, Cleveland 1, Ohio.
Advertisement

New Publications

Field Welding. Complete provisions for arc- and gas-welded construction of bulk storage tanks for holding liquids at atmospheric pressure are detailed by the American Welding Society in a 19-page bulletin, entitled *Standard Rules for Field Welding of Steel Storage Tanks.* Copies may be purchased from the American Welding Society, 33 West 39th Street, New York 18, N.Y., at 50 cents each.

Timber Construction. A paper on "Modern Timber Construction in Europe," by E. George Stern, Assoc. M. ASCE, presented at the Society's 1947 Fall Meeting, has been reprinted by the Virginia Polytechnic Institute as Engineering Extension Series Bulletins Nos. 45 and 46. These reprints are available upon application to the Engineering Extension Division, Virginia Polytechnic Institute, Blacksburg, Va.

Paints for Masonry Walls. Complete data on the relative durability and performance of four types of masonry paints are given by the National Bureau of Standards in its Report 110, *Paints for Exterior Masonry Walls.* The 19-page illustrated report is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 15 cents a copy.

Mathematics and Mechanics. Important contributions in the fields of applied mathematics, mathematical physics, and mathematical analysis will appear in a new quarterly, *Communications on Applied Mathematics,* issued by the Institute for Mathematics and Mechanics at New York University. Subscriptions should be sent to Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N.Y. Yearly subscriptions are $8, single copies $2.50.

Employee Training Courses. To acquaint employees and prospective employees with the various training courses available at its Peoria, Ill., plant, the Caterpillar Tractor Co. has issued two training pamphlets—*Trained Men* and *College Graduates Where Now.* The first of these pamphlets outlines the engineering cooperative training course, in which trainees alternate study at "Caterpillar" and at an engineering college. The college graduate training, shaped into a 50-week period, is covered in the *College Graduates Where Now.* Both pamphlets may be obtained by writing the company's training department.

Street Construction, Cincinnati. A symposium on "Street Construction and Maintenance Practice in Cincinnati," presented at the 44th annual convention of the American Road Builders' Association, has been issued by the Association as Municipal Bulletin No. 126. One of a series presenting the reports submitted at the various convention sessions, the present bulletin may be obtained from the American Road Builders' Association, 1319 F Street, N.W., Washington 4, D.C.

Bureau of Reclamation. Young engineering and scientific graduates are invited to consider career openings in the 30 technical branches of the Bureau of Reclamation in a recent illustrated pamphlet, *Developing the Resources of the West with the Bureau of Reclamation.* Inquiries should be addressed to the Bureau in Washington, D.C., or Denver, Colo.

Water Power, Canada. Present and potential water-power resources of Canada are reviewed and analyzed in a recent release of the Department of Mines and Resources of the Dominion Water and Power Bureau. The present review, which covers hydrometric investigations to the end of 1947, may be obtained from the Dominion Water and Power Bureau, Ottawa, Canada.

Subsurface Drainage. An abstract of subsurface drainage investigations, made by the Army Corps of Engineers in 1945 and 1946, has been made available by the Committee on Subsurface Drainage of the Highway Research Board. Copies of the abstract may be obtained from the Board, 2101 Constitution Avenue, Washington, D.C., and the full report is available upon request on a 30-day loan basis.

Steel Fabrication. A detailed description of modern forming procedures, especially in their application to chromium-nickel stainless steels, is given in a 300-page book, *Forming of Austenitic Chromium Nickel Stainless Steels,* compiled by the International Nickel Co. Methods discussed include bending and straight flanging; forming of curved sections and tubing; deep drawing; die forming; and forming of contoured-flanged parts. Copies may be purchased from the International Nickel Co., Inc., 67 Wall Street, New York 5, N.Y., at a cost of $4 each.

Technical Bibliographies. Numerous rare and unpublished bibliographies on scientific and technical subjects are now available, as the result of the formation of a pool of unpublished bibliographies by the Special Libraries Association. A complete listing of the bibliographies may be obtained from Ralph H. Hopp, technical librarian of the Battelle Memorial Institute, Columbus, Ohio, where the bibliographies are kept.

Patents. Printed copies of patents and design patents are available on a weekly subscription basis, upon application to the U.S. Patent Office, Department of Commerce, Washington, D. C. The annual fee for this service is at the rate of $1 for entry of an order for one subclass and 10 cents for each additional subclass.

Hydraulic Investigations. Issuance of three new Waterways Experiment Station bulletins has been announced by the Army Corps of Engineers. These are Technical Memorandum No. 3-245, entitled *Laboratory Investigation of Filters for Enid and Grenada Dams;* Technical Memorandum No. 3-250, on *Investigation of Wooden Well Screens for Grenada, Enid, and Sardis Dams;* and Memorandum No. 2-244, which summarizes model investigation of plans for improvement of the St. Johns River from Jacksonville to the Atlantic Ocean. Copies are available from the Waterways Experiment Station, Vicksburg, Miss., at a cost of $1 for Memoranda 3-245 and 3-250, and of $1.50 for Memorandum 2-244.

NEWS OF Engineers

Joseph B. Diamond, contract and construction lawyer associated with the New York firm of Bleakley, Platt, Gilchrist & Walker, has been named deputy commissioner of the Department of Public Works, New York. A former professor of physics at St. John's University, from which he received his law degree, Mr. Diamond has been engaged as engineer on many public improvements, including subways, tunnels, highways, sewers, parks, aqueducts, sewage disposal plants and buildings in and around New York City. During the war he served as lieutenant commander with the Seabees, receiving commendation for his four years' service in the Aleutians and the Pacific.

Joseph B. Diamond

Howard P. Maxton recently was elected secretary and assistant treasurer of the Raymond Concrete Pile Co. of New York. He joined the company in 1945 as assistant secretary and assistant treasurer. He was head of the accounting and auditing division of the U.S. Navy Department, Bureau of Yards and Docks, from 1941 to 1945, during which period he developed the Navy manual, "Accounting, Auditing and Control of Cost-plus-Fixed-Fee Contracts."

Ned Williams is now chief of operations at the electromagnetic plant and deputy chief of the Clinton (Tenn.) Production Division of the Atomic Energy Commission. He was for 13 years assistant bridge engineer of the Wyoming State Highway Department.

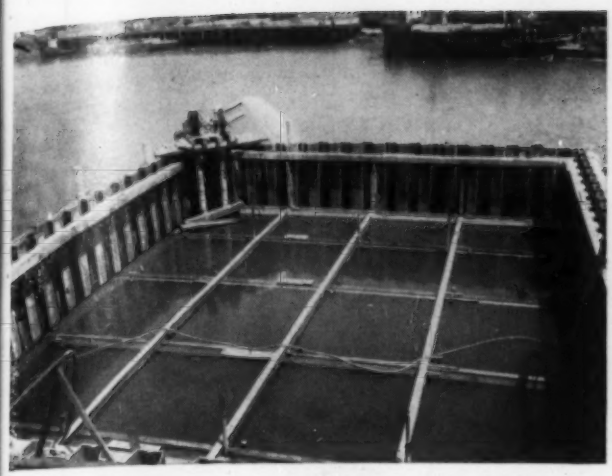
W. R. LaDue, superintendent of the Bureau of Water and Sewerage, Akron, Ohio, has been appointed American Public Works Association representative on the Joint Committee on Cathodic Protection.

Robert A. Van Wye recently joined the consulting engineering firm of Kenneth H. Larkin & Associates in Kansas City, Mo.

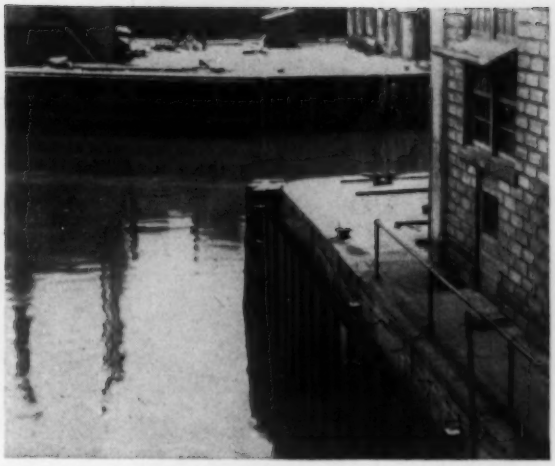
Frank W. Miller, construction engineer with the Lehigh Structural Steel Co., Allentown, Pa., is the newly elected president of the American Hot Dip Galvanizers Association.

Edmund M. Shanley recently became project manager for the Walsh Construction Co., New York City. He was formerly with Fred J. Early, Oakland, Calif., contractor.

Harold K. Palmer has established a consulting practice in Los Angeles, following his retirement as principal hydraulic and electrical engineer for the Los Angeles County Sanitation District.



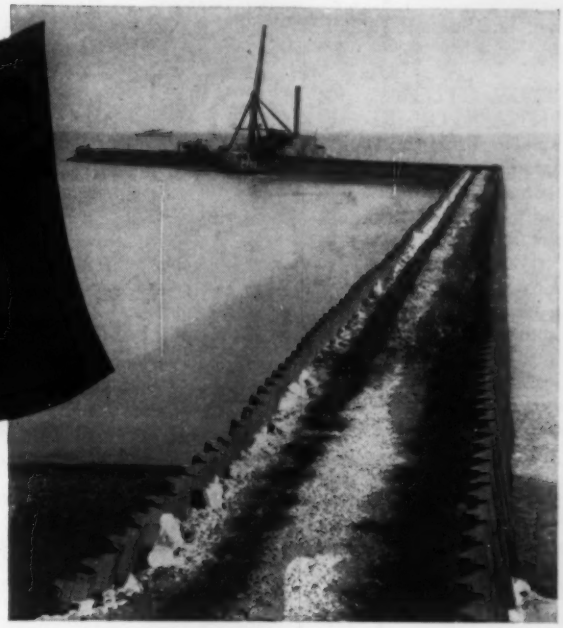
LESS BRACING NEEDED HERE. The high section strength of the U·S·S Steel Sheet Piling used to build this 50′ x 70′ cofferdam reduced, the amount of bracing and provided more working room—factors which speeded the construction of the double-leaf bascule bridge across the Oakland Estuary.



SOLVING A PROBLEM of lower lake levels. When the wooden piling under this dock started to deteriorate due to exposure as the water level fell, the owner simply surrounded the dock on the water sides with a strong wall of U·S·S Steel Sheet Piling.

To keep earth and water in place—

U·S·S STEEL SHEET PILING



600 TONS OF U·S·S STEEL Sheet Piling are used in this 800-ft. pier and breakwater to assure permanent protection of Chicago's North Shore Park. Positive interlock is continuous through the lengths of the piling, assuring practical sand-and-water tightness.

IN CUT-OFF and core walls for dams and dikes, in wharves, slips, seawalls, in bridge pier retaining walls and in railroad and highway abutments, U·S·S Steel Sheet Piling offers easily installed construction that is strong, rugged and lasting. Forming a continuous wall, U·S·S Steel Sheet Piling offers an invaluable and versatile construction medium for any project involving the retention and control of earth or water, it offers the double advantage of speed and economy.

U·S·S Steel Sheet Piling is made of straight-web, arch-web, and Z-sections in a complete range of sizes and sections.

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UNITED STATES STEEL

DELEGATES, REPRESENTING 1,250 MEMBERS of five West Coast employee organizations, are photographed at first annual convention of National Professional Association of Engineers, Architects, and Scientists, held recently in Portland, Ore. Seated, left to right, are: Dr. J. T. Horeczy, observer for Society of Professional Chemists and Engineers; Oscar G. Goldman, San Francisco Area Group of Professional Employees; Sterling S. Green, Los Angeles, president; and Donald B. Slawson, Portland, secretary-treasurer. Standing, in same order, are: ASCE Western Representative Walter E. Jessup; B. S. Rasmussen, observer for Association of Industrial Scientists; Richard A. Henning, Seattle Professional Engineering Employees Association; Donald R. A. Jones, Southern California Professional Engineering Association; Orland E. Buckius, Sacramento Group of Professional Engineering Employees; Benjamin F. Collins, Southern California Professional Engineering Association; and Kenneth G. Tower, Engineers Guild of Oregon.

NEWLY ELECTED OFFICERS OF National Professional Association of Engineers, Architects, and Scientists are pictured at recent first annual convention of organization in Portland, Ore. From left to right are Sterling S. Green, Los Angeles, president; Oscar G. Goldman, San Francisco, vice-president; Donald B. Slawson, Portland, secretary-treasurer; and Ralph W. Hutchinson, Sacramento, director. All are ASCE members. Director Richard A. Henning, Seattle, not shown.

Lewis A. Bosworth has been assigned as project engineer and resident representative to supervise construction of the $5,000,000 Fort Wayne, Ind., Veterans Hospital. He is senior construction engineer for the Detroit District Office, Corps of Engineers.

J. R. Horner, formerly a project engineer with the Federal Public Housing Authority, is now regional engineer of the mid-Atlantic regional office of the Structural Clay Products Institute, Philadelphia.

John F. Willis has been appointed engineer of bridges and structures for the Connecticut State Highway Department. He had previously been engineer of bridge design.

Col. Frank W. Cawthon, of Dallas, Tex., recently was awarded the Legion of Merit Medal by the War Department for his work while serving the Mid-Western District, Air Material Command at Wichita, Kans., and Los Angeles, from 1941 to 1945. The citation said in part: "for brilliant staff work in solving the many problems incident to aircraft production."

Owen G. Stanley, Jr., formerly associate engineer in the U.S. Engineers' Sacramento office and later with the Western Pacific Railroad, recently became an associate transportation engineer with the Public Utilities Commission at San Francisco.

Elmer K. Nelson is in Washington, D.C., as an engineer consultant for the U.S. Senate Committee on Interior and Insular affairs. He formerly was with the Branch of Project Planning for the Bureau of Reclamation.

L. A. Lovell, for the past ten years affiliated with the firm of Parsons, Brinckerhoff, Hogan & Macdonald in their New York office and in South America, has accepted a position as design engineer with the International Engineering Co., Inc., of Denver, Colo.

Dwayain K. Ford is now assistant district airport engineer for the state of Montana with the Civil Aeronautics Adminstration. His headquarters are at Helena. Mr. Ford formerly was airport disposal engineer at Salem, Ore.

Scott P. Hart has been appointed state highway engineer of Montana by Gov. Sam C. Ford. A member of the Montana highway department since 1923, Mr. Hart was formerly materials engineer. He succeeds **Howard W. Holmes** who was relieved of the post at his own request after seven years of service. Mr. Holmes is now bridge engineer.

Robert B. Rhode recently accepted a position as bridge engineer with the Duluth, Missabe and Iron Range Railway Co., with headquarters at Duluth, Minn. He was previously division engineer of the Northern Pacific Railway at Missoula, Mont.

Milton S. Aronstam, formerly associated with the Sherwin-Williams Co. as director of safety and in a similar capacity with the War Department Corps of Engineers, has been made chief of the health and safety branch of the Office of Chicago Directed Operations of the U.S. Atomic Energy Commission.

A. S. Bedell was elected chairman of the executive committee of J. E. Sirrine Co., Greenville, S.C., engineering firm, at its recent annual meeting. **Henry L. Hagerman** was named vice-chairman.

Commander Peter Corradi, CEC, U.S. Navy, recently was assigned as base construction officer, Service Force, Atlantic Fleet. Prior to this, he was public works officer at the Naval Training Center, Bainbridge, Md., and at the Naval Air Station, Lakehurst, N.J. He commanded the 33rd Naval Construction Battalion and the 39th Naval Construction Regiment during World War II.

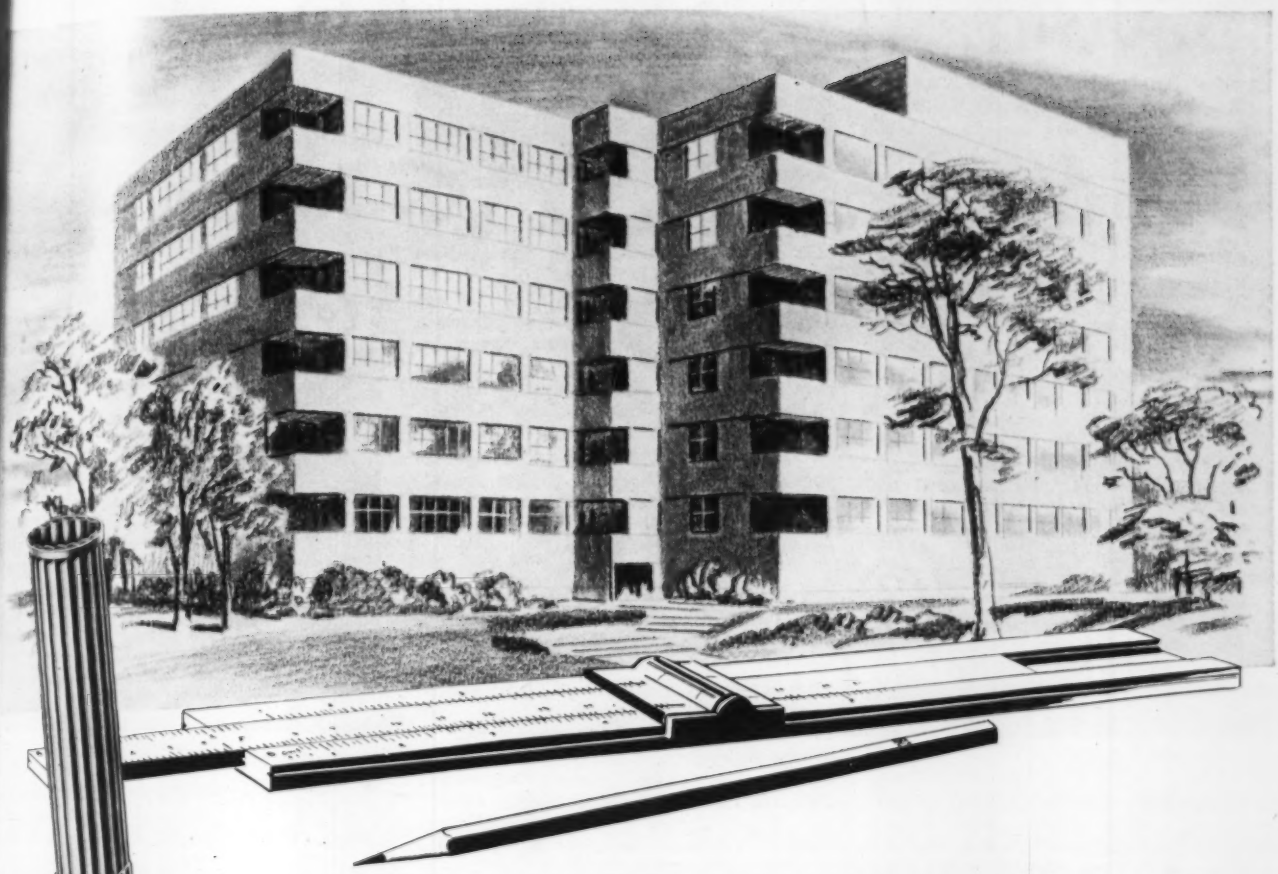
James W. Weston has been appointed general superintendent of plant, in charge of power, track and structures for the Philadelphia Transportation Co., with which he has been affiliated since 1921. He was formerly superintendent of building construction for the company.

D. J. Faustman recently was named traffic engineer of the City of Sacramento, Calif. He formerly was transportation engineer for the Public Utilities Commission of California.

Dwight H. Bray, head of the division of design of the Kentucky Highway Department, has been named chief highway engineer for the state, succeeding **Thomas H. Cutler** who became consulting engineer on the department's technical staff. Mr. Bray has been with the Kentucky Highway Department since 1920, and Mr. Cutler joined the department as chief highway engineer in 1936.

Sherman K. Jackson is district engineer of a new district office of the U. S. Geological Survey at Oklahoma City, Okla. He entered the Geological Survey in 1931, and has served in its Washington, D.C., Iowa City, and Fort Smith, Ark., offices.

William H. Ogden, associated with the New York Water Service Corp. since 1928, recently was elected president of the organization. He had previously held the position of administrative vice-president. Mr. Ogden also is president of the South Bay Consolidated Water Co. and vice-president of the Western New York Water Co. and the Rochester & Lake Ontario Water Service Co., subsidiaries of the New York corporation.



Put tomorrow's dreams on a solid foundation . . . with MONOTUBES

JOB-PROVED — economy-proved — quality-proved . . . that's Monotube tapered steel piles. And that's why so many construction projects *start* with Monotubes.

Experienced architects and builders have long depended upon them because—

Monotubes' fluted, tapered design speeds driving;

They are easily extendible, right on the job;

Their sturdy construction eliminates use of driving mandrel;

Light in weight, they are easily and quickly handled;

Monotubes' tubular construction makes inspection, before concreting, quick and easy.

Plan a solid foundation *now* for tomorrow's projects—buildings, piers, bridges, airports, highways — with *Monotubes.* They can make the time-and-cost-savings you want. Gauges, sizes and tapers to meet varying soil conditions. For complete information, write The Union Metal Manufacturing Co., Canton 5, Ohio.

We regret the present extended delivery schedules due to the steel shortage, but you will find Monotube Piles well worth waiting for.

UNION METAL

Monotube Foundation Piles

Arthur James McNeil, since 1943 city traffic engineer for Sacramento, Calif., recently was retired. He had been in the Sacramento city engineering department since 1940. Mr. McNeil became a life member of the Society in 1945.

John M. Hayes has joined the staff of the school of civil engineering and engineering mechanics at Purdue University, his alma mater, as associate professor of structural engineering. He was with the TVA for eleven years, and for the past two years was located at Little Rock, Ark., as district bridge engineer with the U.S. Public Roads Administration.

Archie N. Carter, until recently associate editor of *Engineering News-Record* and *Construction Methods* and Washington editor of the publications since 1945, has been appointed manager of the Highway Contractors' Division of the Associated General Contractors of America. He will also act as co-secretary of the joint cooperative committees between the organization and the American Association of State Highway Officials and the National Association of State Aviation Officials.

W. W. Sullivan and **V. C. Wordrup** are partners in the newly formed Sullivan-Wordrup Construction Co., at Fort Lauderdale, Fla. During the war, Mr. Sullivan served as an officer in the Corps of Engineers in charge of general construction work in Florida and in South America. Mr. Wordrup served in the same places and in the same capacity as a civilian employee of the War Department.

Robert C. Lipman has resigned as project engineer with the Federal Works Agency to accept a position as engineer with the U.S. Bureau of Reclamation, with headquarters in Indianola, Nebr.

John A. Ely, professor of civil engineering at Cooper Union, New York City, recently was elected to honorary membership in the Engineering Society of China. Mr. Ely was professor of engineering at St. Johns University, Shanghai, from 1912 to 1940 except for the 1927–1928 school year. He has been on the Cooper Union engineering faculty since 1942.

H. T. Livingston is newly appointed chief engineer, maintenance of way and structures for the Chicago, Rock Island and Pacific Railway at Chicago. He was formerly engineer of bridges.

Theodore S. Bogardus recently was appointed city engineer of Bay Village, Ohio. He will continue his work as professor of engineering at Baldwin Wallace College, Berea, Ohio.

Donald Derickson, professor emeritus of engineering at Tulane University, recently was made an honorary member of the Louisiana Engineering Society in recognition of his "outstanding career in engineering education, his proficiency as a civil engineer and his long record of service to the state society." He became head of the school of civil engineering at Tulane in 1912 and was retired in 1945.

Deceased

Thomas George Gordon Beck (Assoc. M. '32) deputy commissioner of works, New Zealand Ministry of Works, died at his home in Wellington, on January 6. He was 47. Prior to 1940, Mr. Beck was engaged in investigations and preliminary surveys of irrigation work in the Mid-Canterbury region and subsequently was engineer-in-charge of construction of this work. During the war he was engaged in defense construction in Wellington, later serving as chairman of the Main Highways Board, and of the Soil Conservation and Rivers Control Council. He was appointed deputy commissioner of works in 1946.

Russell Chase (Assoc. M. '05) retired engineer of Portland, Ore., died on March 6, at the age of 82. Mr. Chase spent most of his career with the Southern Pacific, going with the organization as a draftsman in 1887. As location division engineer, with headquarters in San Francisco, he was in charge of location of a 108-mile stretch of difficult construction between Eugene and Klamath Falls, Ore. He retired in 1932.

Charles Richard Hedke (M. '11), died at his home in Omaha, Nebr., on March 11, at the age of 70. Mr. Hedke began his career with the Kilby Construction Co. as an engineer in the building of sugar factories in northern Colorado, later working on irrigation projects in that state. He was engaged in consulting work before World War II. During the war and until his retirement in 1946, he was with the Army Corps of Engineers at Denison, Tex., and Omaha, Nebr.

Harold Gilbert McGee (Assoc. M. '18), tax expert, died at his home in Hudson, Ohio, on February 13. His age was 59. He was director of the Akron (Ohio) Chamber of Commerce Municipal Research Bureau a position he had held since 1923. Mr. McGee began his career as a teaching assistant in surveying at the University of Michigan, from which he was graduated in 1913, and had served as assistant engineer of the Ohio and Michigan state boards of health and as sanitary engineer for the City of Jackson, Mich. During World War I he was an officer in the Army Sanitary Corps.

James Edward Maloney (M. '08) retired engineer of Littleton, Colo., died in a Denver, Colo., hospital on March 22. His age was 84. Mr. Maloney was former Colorado state highway engineer, retiring ten years ago. Early in his career he was a member of the Nicaragua Canal Commission engineering board. He went to Colorado in 1899 as construction engineer on Cheesman Dam, later becoming resident engineer for the South Platte Division of the Denver Union Water Co. Mr. Maloney was appointed secretary and chief engineer of the highway commission when it was organized in 1910. Later when the department was changed from the commission form, he became assistant highway engineer.

Seymour Husted Phelan (Assoc. M. '26) city engineer of Piedmont, Calif., died at his home there on January 15. He was 68 years of age. Mr. Phelan was engaged in private practice as a surveyor, and civil and landscape engineer in Santa Barbara from 1914 to 1919, and was maintenance-of-way engineer for the San Francisco-Sacramento Railroad Co. from 1919 to 1927. Prior to 1914, he was engaged in various railroad positions in California and Nevada.

James Hervey Herron (M. '26) president of the Cleveland, Ohio, consulting engineering firm bearing his name, died in Fort Lauderdale, Fla., on March 29. He was 73. Prior to founding his own firm in 1909, Mr. Herron was vice-president of the Bury Compressor Co., of Erie, Pa., and held executive positions with the Motch & Merryweather Co. and the Detroit Steel Products Co. A former president of the American Society of MechanicalEngineers and the Cleveland Engineering Society, Mr. Herron was recently active in formation of the Cleveland Technical Societies Council. During World War II, he served on the President's national fuel efficiency program, and he was co-author of an extensive report on a program for expansion of the city water department. He had been president of the Cleveland Section of the ASCE.

James H. Herron

Joseph Joslin Strachan (Assoc. M. '19) general staff manager of the sales department of the Carnegie-Illinois Steel Corp., Pittsburgh, Pa., died at his home there on April 2. Mr. Strachan was construction engineer for Westinghouse, Church, Kerr & Co., of New York, until World War I, in which he served as a lieutenant in the Navy Civil Engineer Corps. Following the war, he was with the General Chemical Co., Congoleum-Nairn, Inc., and Sanderson & Porter, of New York. In 1940 he became chief engineer of the Carnegie-Illinois Steel Corp.

Charles Morton Strahan (M. '10) professor emeritus of civil engineering and professor of applied mathematics at the University of Georgia, Athens, Ga., died there on December 28, 1947, though the Society has just been informed of his death. On the staff of the university for 62 years, Professor Strahan joined the engineering faculty there upon his graduation in 1883. He taught chemistry, mathematics, and various engineering courses, and for a number of years was dean of the School of Engineering. An authority on highway engineering, he headed a movement to obtain adequate highway legislation in the state of Georgia, and was principal author of the law establishing the State Highway Department.

Joseph Smith Stull (M. '37), for the past 20 years senior designing engineer for the Board of Water Supply, New York City, died at his home on Staten Island, on March 18. His age was 65. Mr. Stull had been a structural designer for the Philadelphia Rapid Transit Co. and an assistant struc-

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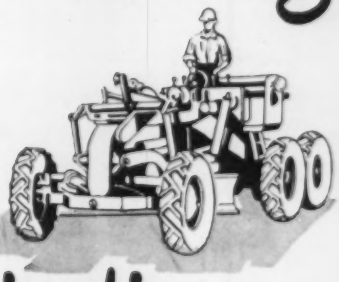

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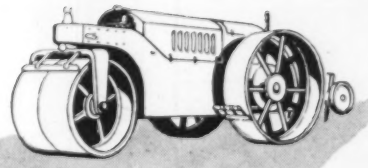

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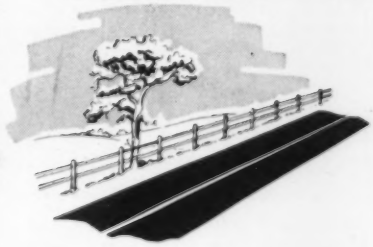

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tural engineer for the Bureau of Buildings in that city. He went to New York as a structural steel draftsman for the Department of Bridges, working later for various corporations as construction manager, assistant engineer, structural designer and assistant general manager. He was with the Austin Co. in Cleveland, supervising design and construction of power and industrial plants, before going to the Board of Water Supply.

James Baldwin Warrack (Assoc. M. '20), died in San Francisco, Calif., on February 19, at the age of 60. He was head of the J. B. Warrack Co., construction firm of Seattle, Wash., which he organized in 1913. Mr. Warrack worked in the engineering department of the Union Pacific Railroad in San Francisco, moving to Seattle with the railroad in 1909. He was one of the organizers and president of the Seattle chapter of the Associated General Contractors.

Albert Leroy Wingert (Jun. 45) surveyor and computer for the National Geophysical Co., at Schulenburg, Tex., was killed in an automobile accident in June 1947, though word of his death has just reached the Society. He was 22, and an alumnus of Louisiana State University, class of 1945.

Charles Rapelye Wyckoff (M. '23) died at Saranac Lake, N.Y., on March 26, at the age of 67. For the past 17 years Mr. Wyckoff had been with the engineering firm of Wallace & Tiernan in Belleville, N.J. From 1906 to 1910, Mr. Wyckoff was assistant engineer for the New York City Board of Water Supply. He was engaged in private practice from 1912 to 1918, and in the latter year became affiliated with the George A. Johnson and Harold C. Stevens construction engineering firm. Later he was a member of the firm of George A. Johnson Engineers, where he remained until 1922.

Carl Wyant (M. '29) died at his home in Santa Barbara, Calif., on February 29. His age was 57. Mr. Wyant was retired general manager and former chief engineer of the Montecito Water District at Santa Barbara. Under his supervision, a $2,600,000 water system, consisting of pipelines, dams, tunnels and reservoirs was constructed. Early in his career he served in various capacities in the Santa Barbara City Engineer's office. He was for a time a member of the firm of Cook, Wyant & Moore, Santa Barbara engineers, engaged in the design and construction of streets, sewer systems and water supplies. He became affiliated with the Montecito Water District in 1921.

Technical Writing—An Easily Acquired Skill

(*Continued from page 44*)

trouble is not so much their use of obscure words, though there is some tendency in that direction, but in the use of an ordinary word in some specialized sense. Thus an automotive engineer, when he speaks of a "job," means a vehicle, while the electrical engineer takes the word to mean the performance of a certain amount of work. On the other hand, the electrical engineer says "jack" when he means a receptacle with connections to electric circuits, while the automotive engineer thinks of it as a device for lifting a heavy weight.

This kind of confusion is avoided if the author keeps always in mind the character of the reader. Then he can determine in advance whether or not the reader will correctly grasp the specialized meaning of the word he intends to use. If there is any doubt about it, the author had better substitute another word. It is a good plan to be on the safe side and to avoid specialized meanings wherever possible. There is almost always a way to say what you want in perfectly plain words whose meaning no one can misunderstand.

Short Words and Short Sentences Are Best

Plain words—and short words—make the best reading anyway. It has been pointed out in a recent government pamphlet based on studies by Dr. Rudolph Flesch at the Readability Laboratory of Columbia University that a simple rule-of-thumb way to measure the simplicity of any piece of writing is to count the total number of syllables per 100 words. If the number of syllables runs much over 150 per 100 words, there is opportunity to improve the writing by using shorter words.

Perhaps you think that rule may be all right when you are writing for children, but that it won't work for grown-ups. Try it and see. For example, count the number of syllables in the first 100 words of this article, which was written without any conscious effort to economize syllables, and you will find the total is 159. Or, count the syllables in one of your own business letters. You will find, unless you are particularly prone to use long words, that your natural style averages only about three syllables to two words. The trouble is that natural style is too often thrown overboard in technical writing, and in its place miraculously appears an unnatural, ponderous style that discourages the reader.

Another handy rule-of-thumb proposed by Dr. Flesch is to limit the average number of words per sentence to about seventeen. There is no magic in that particular number. It just happens to be a good average for easy reading. Sixteen or eighteen would be perfectly acceptable. But if the average should drop to ten, the writing would seem choppy, and if it should rise to twenty-five, the reader would have to work appreciably harder to get the meaning. Short sentences also make the author's job easier by simplifying the punctuation problem. You aren't likely to get into any serious punctuation difficulties when you have only seventeen words to handle.

Revise and Re-Revise

Most important of all the things to be done in the polishing process is to revise, and revise, and re-revise. Sometimes an engineer feels that it is a confession of inexperience to revise a piece of technical writing. That is a mistaken idea. Actually, the reverse is true. Scarcely anyone can write a thing the best way at the first attempt. A second attempt is almost sure to produce a better piece of writing, and a third attempt, a still better piece. Willingness to revise, far from indicating a lack of experience, shows that the writer is approaching his task in a spirit of craftsmanship, and that he realizes that a first-class result comes only from persistent effort.

Along with willingness to revise should go a willingness to take suggestions from others. Here a middle-of-the-road policy is best. The author who seeks advice from a multitude of counselors is likely to end in a maze of conflicting opinions. On the other hand, the most experienced authors often find suggestions extremely useful. Certainly, therefore, an author of limited experience should not feel himself above taking suggestions.

Simple Rules for Technical Writing

In brief, therefore, the secret of success in technical writing is short words and short sentences presenting the author's thoughts in clear, logical order—plus painstaking revision. Much more might be added about introductions, conclusions, illustrations and other details, but those are matters that can be considered after the fundamentals have been acquired.

Writing for general magazines and newspapers, because of the different type of readers to whom it is addressed, requires techniques different from those needed for engineering papers and articles. Consideration of ways to acquire these techniques is beyond the scope of the present discussion. They are not likely to be of primary concern to the average engineer, anyway. But the technique of good technical writing should be of concern to him and, fortunately, it is one that can be easily acquired.

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Constructing the Watauga Project

(*Continued from page 26*)

Highway relocation is a major item in the construction of the Watauga Project. Sixty-one miles of state and county roads will be inundated, of which the principal one is a 7.5-mile stretch of Tennessee State Highway 67 which connects Hampton and Mountain City, both of which are on through U.S. routes. Inundated also will be the town of Butler, the first incorporated community to be completely flooded by the TVA.

The substitute system was planned to provide adequate highway facilities for the inhabitants who remain in the surrounding territory after construction of the reservoir, as well as to provide satisfactory roads for the through traveler and visitor to the region. In general, the relocations are made the equivalent in standard to the highway or bridge which is being replaced.

The most spectacular single feature of the highway relocations is the bridge upon which the state highway will cross the reservoir. Its height of 270 ft from the present river bed to the road surface makes it one of the highest highway bridges east of the Rocky Mountains. The bridge will be a three-span, continuous-deck-truss structure, having a total length of 1,092 ft, with a 492-ft-long center span flanked on each side by a side span 300 ft long.

Completion Scheduled for Late 1949

Progress of excavation and concrete lining on the diversion tunnel permitted river diversion on June 16, 1947, two weeks ahead of schedule. Closure will be made by December 1, 1948, in time to store next winter's runoff. Power production, originally planned to start in July 1949, may be delayed for a few months on account of late generator delivery.

Construction of the Watauga Project is being coordinated with construction of the South Holston Project which is now being built on the South Fork Holston River near Bristol, Tenn. A staggered schedule for the two projects is employed to achieve maximum efficiency in the utilization of construction equipment and trained personnel. Watauga was started first, and as it nears completion, men and equipment are being moved to the South Holston Project.

Project planning and design in the TVA are directed by James S. Bowman, chief water control planning engineer, and Robert A. Monroe, chief design engineer, respectively, under the supervision of C. E. Blee, chief engineer. All are Members of ASCE.

Australia Follows Master Plan for Capital City of Canberra

(*Continued from page 35*)

live load of 110 lb per sq ft assumed for all floors of the building. The minimum design thickness of ground-floor slabs is 15 in.

3. All external walls between the elevated ground floor and the lower ground floor (street level) are 24 in. thick with vertical and horizontal reinforcement placed near both faces of the walls.

Continuous-Frame Method of Design

Requirements of the American Joint Committee Report on Standard Specifications for Concrete and Reinforced Concrete of 1940 were followed in the design of the building. Experience showed the value of the continuous-frame method, which was found to simplify the theoretical studies of rigid building frames, to reduce considerably the time required for the design procedure, and to give results sufficiently accurate for all practical purposes. With the introduction of a new continuous-beam design sheet, which gives a full picture of the computations at a glance, the continuous-frame method had the further advantage of permitting easier checking.

Concrete used in the building is divided into four classes. Fine and coarse aggregates are combined to give the grading shown in Table I, and cement and water are proportioned as given in Table II. Concrete in Classes A and B is used for columns, as specified in the plans; Class C concrete is employed for all work not otherwise specified; and Class C1 is used for all footings, bearing walls and retaining walls below the lower ground-floor level and for the lower slab of the subbasement floor.

Estimates indicate that this structure, containing 27,000 cu yd of concrete and 2,700 tons of steel, will cost $1\frac{3}{4}$ million Australian pounds, or 6 million dollars.

Construction was started in the spring of 1948 and is scheduled for completion in four years.

Building design is under the direction of the Federal Department of Works and Housing, M. W. Mehaffey, Director of Works. The detailed structural design was done by the writer. Construction is under the direction of the Canberra Branch of the Department.

Comprehensive Analysis Shows Highway Needs in Michigan

(*Continued from page 42*)

$179,141,000 a year. The annual cost of meeting these over-all needs in 15 years would amount to $158,144,000.

Financing the Program. A long-range program to meet present deficiencies should be carried out within 12 to 15 years. A total of $73 million in additional funds would be required annually to finance a 12-year program and $51 million additional annually for a 15-year program. All additional funds cannot be raised through motor vehicle taxation. State-collected motor-vehicle revenues should be spent mainly on general-service roadways—state trunklines, primary county roads, and major city streets. Substantial responsibility for financing local county roads and local city streets should rest on the local tax structure. Present statutes governing distribution of state-collected motor-vehicle revenues to the State Highway Department, counties, and cities, should be repealed and a new formula based on needs, as set forth in this report, should be enacted.

Highway Administration. To enable highway agencies to take on the heavy additional responsibilities of an expanded highway program requires state-wide coordination of highway administration, strengthening of administrative responsibility over highway matters, and continued improvement in administrative practices. In all cases where state-collected road funds are expended, counties and municipalities should submit for approval by the State Highway Commissioner annual improvement programs based on long-range plans and make yearly reports to him on financial transactions and the condition of road systems. The State Highway Commissioner should include in his biennial report to the legislature a section describing progress made by all highway agencies in carrying out the over-all program, including an accounting for all expenditures and a summary of the program scheduled for the next biennium.

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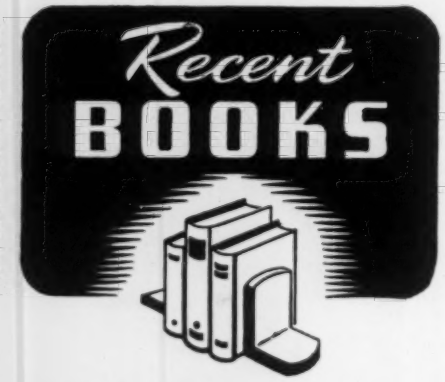
Pure Oxygen in Bio-Precipitation Process Promises Reduced Sewage Treatment Costs

(*Continued from page 33*)

tivated sludge process. Or, in other words, for the same quantity of sewage treated, about one-quarter of the plant is required. The cost of oxygen at $4 per ton was found to be about equal to the cost of compressing air at about 1 cent per kwhr. Shown also are the results of a run made with air rather than with oxygen. With air, only very low loadings are possible, with necessarily high recirculation rates.

In conclusion, all evidence points to the possibility of great savings in sewage purification costs by the use of the bio-precipitation process. A more precise assessment of its advantages must await the operational results of a proposed pilot plant, negotiations for the construction of which are already under way.

This article is based on an address delivered by the author at the Centennial Celebration of the Founding of The Lawrence Scientific School, February 13, 1948.



BEANSPRUCHUNG VON STRASSENBELÄGEN DURCH METALLISCHE SYSTEME, by E. Zipkes. Zürich, Switzerland, Eidgenössische Technische Hochschule, Institut für Strassenbau, Mitteilung Nr. 4. Verlag A.G. Gebr. Leemann & Co., Zürich, 1947. 103 pp., illus., diagrs., charts, tables, 11½×8 in., paper, 25 Sw. frs. This study investigates the effect of metal wheels and treads on road surfaces. The wheel systems are classified according to their condition, purpose, and method of use. In the second section are evaluated the magnitudes of the maximum specific working pressures, and the forces produced are separated and broken down into their precisely determined factors. In the third section, the ruts left in the road surface from the pressure of these metallic systems are also considered, with an analysis of harmful and unharmful practices. Photographs effectively illustrate the points made in the study.

CONSTRUCTION DES PONTS. (Études de Synthèse et de Documentation l'Actualité Technique.) By R. Vallette, preface by L. Grelot. Dunod, Paris (92 Rue Bonaparte), 1947. 137 pp., illus., diagrs., tables, 8¼×5 in., paper, 340 frs. Of interest to engineers, architects, and bridge builders, this book is a survey of the evaluation of the design and construction of bridges. It contains general rules for determining the most appropriate type and material for new bridges. The analysis of bridges is dealt with in a general way. An extensive bibliography is included.

CONSTRUCTION ESTIMATES AND COSTS, 2 ed. By H. E. Pulver. McGraw-Hill Book Co., New York and London, 1947. 653 pp., charts, tables, 9¼×6 in., cloth, $6. Instructions are given for estimating from the preliminary investigations through complete detailed estimates. Excavations, all parts of buildings, concrete, structural steel, material transportation, and profit are among the items considered. Each element of construction work is discussed separately. This revised edition takes into consideration the recent rise in wages and prices and the scarcity of materials. The preparation and use of simple diagrams for estimating purposes are emphasized to increase the practical value of the book.

ECONOMICS OF TRANSPORTATION, 3 ed. By D. P. Locklin. Richard D. Irwin, Inc., Chicago, Ill., 1947. 885 pp., diagrs., charts, maps, tables, 9¼×6 in., cloth, $5.50. This well-documented volume provides comprehensive coverage of the fields of water, highway, air, railroad and pipeline transportation. The new edition has been revised to include discussion of new legislation, and some of the issues which arose from the administration of the laws are treated. Other important changes are the expansion of the chapter on transport coordination and the omission of the one on common-carrier liability.

ELEMENTARY MECHANICAL VIBRATIONS. By A. H. Church. Pitman Publishing Corporation, New York and London, 1948. 200 pp., diagrs., charts, tables, 9¼×6 in., cloth, $3.25. Based upon courses given at New York University, this book covers the elementary principles and serves as an introduction to more extensive study of vibration problems. The author stresses the physical rather than the mathematical explanations of the phenomena. One chapter is devoted to balancing. A knowledge of mechanics and calculus is assumed. Extensive use of examples clarifies the text, and problems, with answers, are given at the end of each chapter.

ELEMENTS OF NOMOGRAPHY. By R. D. Douglass and D. P. Adams. McGraw-Hill Book Co., New York and London, 1947. 209 pp., diagrs., charts, tables, 9¼×6 in., cloth, $3.50. This book deals with the study, understanding, creation and practical use of the alignment chart. Seven elementary types are presented, including the circular nomograph. Practical aids to hasten and simplify the completion of the theoretical solution and the drafting of the chart are developed. Among these are the systematic adjustment of the scale measurements to the base line of the diagram, the regular use of prepared forms, and the practice of checking solutions. Compound alignment diagrams are dealt with in the final section.

ENGINEERING APPLICATIONS OF FLUID MECHANICS. By J. C. Hunsaker and B. G. Rightmire. McGraw-Hill Book Company, New York and London, 1947. 494 pp., illus., diagrs., charts, tables, 9½×6 in., cloth, $6. The underlying equations of basic fluid mechanics are developed from first principles by consideration of flow through a fixed region of space. This same technique is followed in the discussion of mass, momentum and energy. Practical applications of theory to airplane performance, turbine and pump characteristics, fluid couplings and other hydraulic machinery are described and illustrated.

ESTHÉTIQUE ET CONSTRUCTION DES OUVRAGES D'ART. By J. Démaret, preface by D. Boutet. Dunod, Paris (92 Rue Bonaparte (VI)), 1948. 126 pp., illus., diagrs., 9×7 in., paper, 1,180 frs. The object of this book is to unite architects and bridge engineers in their work of designing and constructing bridges so that new bridges may be beautiful as well as useful. The author shows the influence of economic and social conditions and technical knowledge of various cultures on the bridges in France. He then discusses the construction of the parts of a bridge and the structure as a whole. One hundred and forty-... pictures and diagrams complement the text.

HISTORICAL APPRAISAL OF MECHANICS. By H. F. Girvin. International Textbook Co., Scranton, Pa., 1948. 275 pp., diagrs., tables, 9¼×6 in., cloth, $3.25. Tracing the history of mechanics from the early Greeks to modern times, this book stresses the relationship of mechanics to engineering education. Divided into three parts, part one discusses the early development of science and scientific thinking. The contributions from the Renaissance through Newton are considered in Part II, while Part III is devoted to the mechanics of materials. A bibliography and chronological tables complete the text.

HYDRAULICS. By H. W. King, C. O. Wisler and J. G. Woodburn. 5th ed. John Wiley & Sons, Inc., New York; Chapman & Hall, London, 1948. 351 pp., diagrs., charts, tables, 8¼×5½ in., cloth, $4. Considerably rewritten and brought up to date, this volume is concerned with the fundamentals of hydraulics and fluid mechanics. The sections on hydrostatics, hydrodynamics, pipes, and open channels have been expanded to include material on the hydrostatic relations for compressible fluids, the terminal velocity and the resistance of an object moving through a fluid, recent methods of computing friction losses in pipes, and discussion on the problems of reservoir discharge pipes. The problems have been redrafted.

INFLUENCE LINES, Their Practical Use in Bridge Calculation. By D. S. Stewart. 2nd ed. Constable & Company, London, W.C.2, 1947. 209 pp., diagrs., charts, tables, 8¼×5½ in., cloth, 12s.6d. Beginning with reaction and shear influence lines in simple beams, the author proceeds to deal with the analysis of various trusses and other bridge members, ending with material on bridge loadings and impact. Selected practical applications have been worked out in full for several types of structures. Although all necessary calculations are included, the mathematics has been kept as simple as possible. The use of graphical integration is demonstrated in the last chapter.

LIGHT METALS IN STRUCTURAL ENGINEERING. By L. Dudley. Published for Temple Press Ltd., Bowling Green Lane, London, E.C. 1, by The English Universities Press Ltd., St. Paul's House, Warwick Square, London, E.C. 4, 1947. 216 pp., diagrs., charts, tables, 8½×5½ in., cloth, 30s. The important principles of the subject of "strength of materials" are covered, with emphasis on the application of these principles to problems involving the use of aluminum, aluminum alloys and magnesium alloys. The book covers much of the information required for the examinations in strength of materials set by the various British professional engineering institutions. Calculus has been used in the explanation of theory, but an understanding of this branch of mathematics is not essential for the majority of the problems and worked examples.

LUMBER, MANUFACTURE, CONDITIONING, GRADING, DISTRIBUTION AND USE. By N. C. Brown. John Wiley & Sons, New York; Chapman & Hall, London, 1947. 344 pp., illus., diagrs., maps, tables, 8½×5½ in., cloth, $4.25. Of interest to those concerned with wood utilization and intended as a textbook for use in professional forestry schools, this volume covers most of the phases of the industry with the exception of logging. The general manufacturing procedures for converting logs into lumber are analyzed, and equipment, sawing methods, power requirements, and the utilization of by-products are discussed. Conditioning, by air seasoning and by kiln drying, is explained, and the grading process is examined. The distribution of lumber through the manufacturer, retailer and wholesaler, and the utilization of the distributed product are dealt with. Constant emphasis is placed on the necessity for efficient and economical methods in all stages of production.

NOMOGRAPHY. By A. S. Levens. John Wiley & Sons, New York; Chapman & Hall, Ltd., London, 1948. 176 pp., diagrs., charts, tables, 9¼×5¾ in., cloth, $3. Of interest to the scientist and practicing engineer, this book presents fundamental principles of the design and theory of an important graphical method. Emphasis is placed on the geometric method of development, and, after the theory is explained, shortcuts are described. A knowledge of algebra, plane geometry, and logarithms is assumed. One chapter is devoted to the use of determinants in alignment chart work. Practical examples of charts and a selected bibliography are included.

PRACTICAL DESIGN OF SIMPLE STEEL STRUCTURES, Vol. 1. By D. S. Stewart. Constable & Company, Ltd., London, W.C.2, 1947. 201 pp., diagrs., charts, tables, 8½×5½ in., cloth, 15s. Usable either as a textbook or a manual, this British work provides detailed information on beam analysis and design and on riveted joints and splices. Introductory chapters discuss shop and drafting room practice and describe the important rolled structural sections. The tables which formerly constituted Vol. III are included in this volume as an appendix. Girders, columns, trusses, bridges, etc., are dealt with in another volume.

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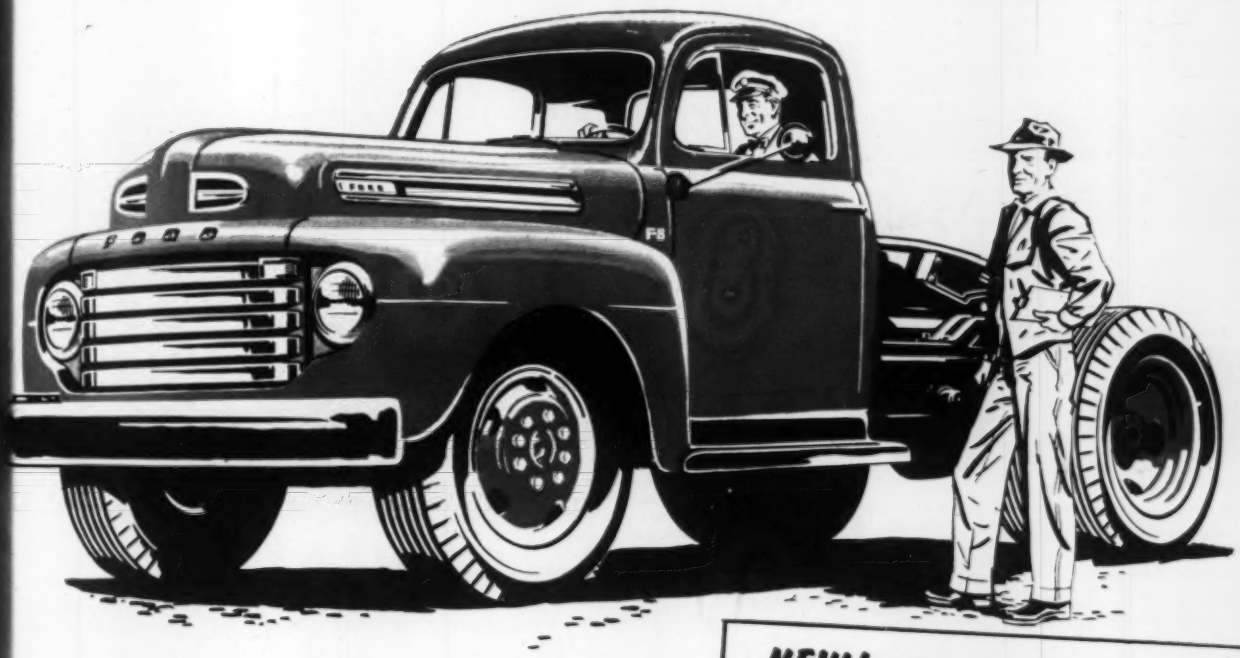

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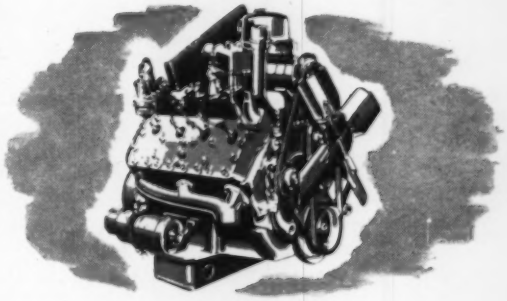

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APPLICATIONS FOR ADMISSION OR TRANSFER

May 1, 1948 Number 5

The Constitution provides that the Board of Direction shall elect or reject all applicants for admission or for transfer. In order to determine justly the eligibility of each candidate, the Board must depend largely upon the membership for information.

Every Member is urged, therefore, to scan carefully the list of candidates published each month in CIVIL ENGINEERING *and to furnish the Board with data which may aid it in determining the eligibility of any applicant.*

It is especially urged that a definite recommendation as to the proper grading be given in each case, inasmuch as the grading must be based upon the opinions of those who know applicant personally as well as upon the nature and extent of his p fessional experience. Any facts derogatory to the personal character professional reputation of an applicant should be promptly commu cated to the Board. Communications relating to applicants are c sidered strictly confidenti

The Board of Direct will not consider the app cations herein contained fr residents of North Ameri until the expiration of days, and from non-resid of North America until expiration of 90 days f the date of this list.

MINIMUM REQUIREMENTS FOR ADMISSION

GRADE	GENERAL REQUIREMENT	AGE	LENGTH OF ACTIVE PRACTICE	RESPONSIBLE CHARGE OF WORK
Member	Qualified to design as well as to direct important work	35 years	12 years	5 years
Associate Member	Qualified to direct work	27 years	8 years	1 year
Junior	Qualified for subprofessional work	20 years	4 years	
Affiliate	Qualified by scientific acquirements or practical experience to cooperate with engineers	35 years	12 years	5 years

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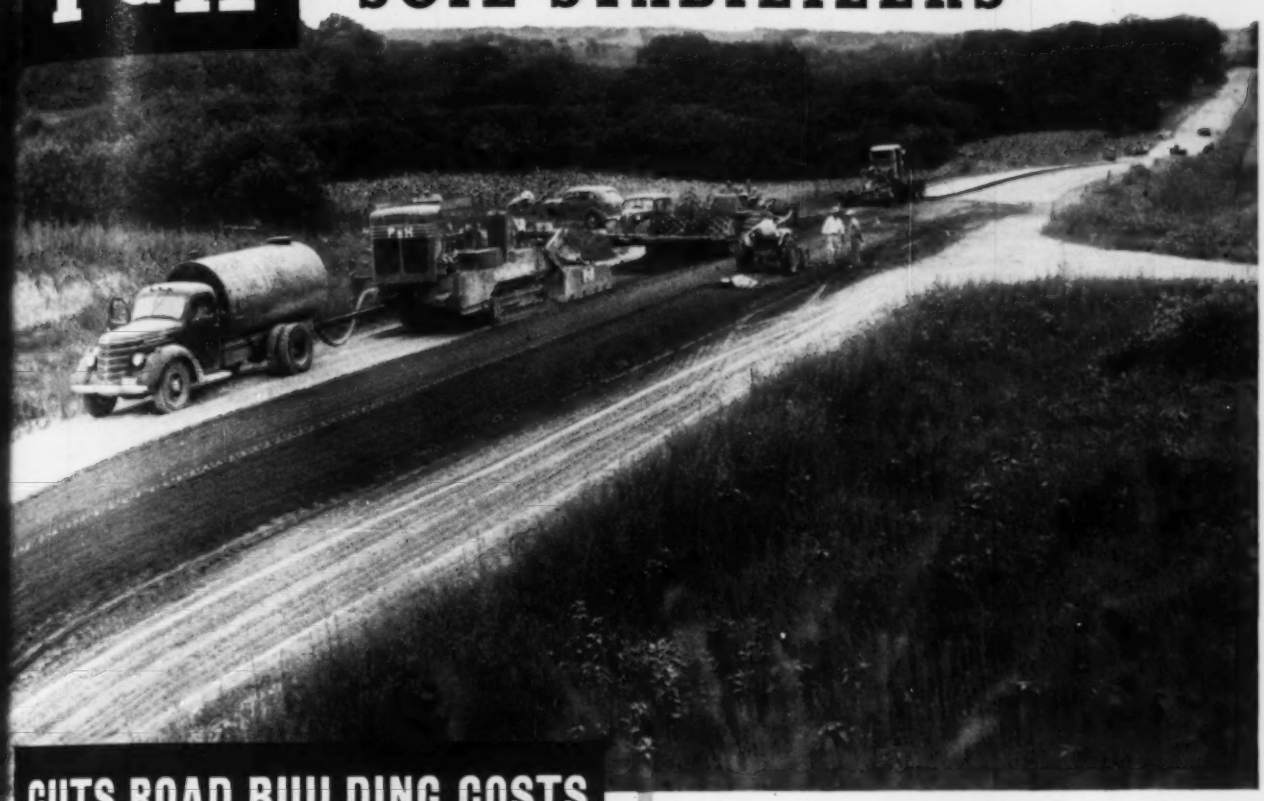

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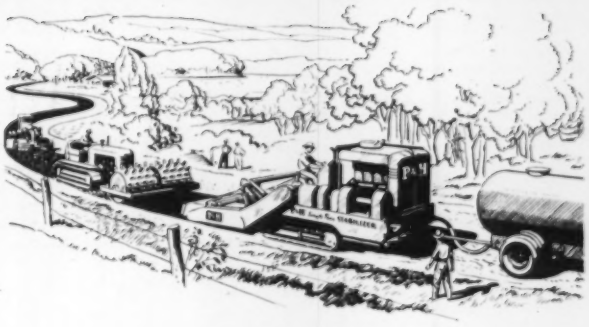

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RAY, KAMALESH (Jun.) (Age 33) Graduate student, Univ. of Colorado; 1942 to 1945 Research Officer, River Research Inst., Govt. of Bengal, India.

REIDY, MAURICE ALPHONSE, JR. (Age 29) Design Engr. (private practice), Boston, Mass.

RENNIS, FRANK GEORGE (Age 29) Structural Designer for E. P. Allabach, Cons. Engr., Upper Darby, Pa.

ROBERTSON, ROB ROY (Age 53) Civ. Engr. P-2, Davis Dam Constr., U.S. Bureau of Reclamation, Davis Dam, Nev.

ROBILLARD, ROBERT JOSEPH (Jun.) (Age 27) Acting City Engr., Benton Harbor, Mich.

RODERICK, LAURENCE (Age 40) Asst. Engr. in charge of field surveys in sanitary, water-works and municipal engineering, Berkeley, Calif.

SADARANGANI, NARAIN RIJHUMAL (Age 39) Sub-Divisional Officer, Central PWD, Govt. of India, No. Tuko Ganj, Indore, India.

SHALER, CLAIR ALFRED (Jun.) (Age 34) Associate Engr., Finkbeiner, Pettis & Strout, Toledo, Ohio.

SHIMAMOTO, GEORGE GENTOKU (Age 43) Engr., Kelly & Gruzen, Archts.-Engrs., at New York, N.Y., and Jersey City, N.J.

SHUKLE, RICHARD JOHN (Age 33) Engr. P-5, Bureau of Reclamation, Sacramento, Calif.

SILBER, VICTOR ARTHUR (Jun.) (Age 35) Engr., Horner & Shifrin, Cons. Engrs., St. Louis, Mo.

SINGLETON, LAUREN WOODROW (Age 35) Asst. Prof. of Civ. Eng., Louisiana Polytechnic Inst., Ruston, La.

SPARKS, ROBERT EARL (Jun.) (Age 35) Lt. Comdr., CEC, U.S. Navy, Staff Comservpac, Fleet Post Office, San Francisco, Calif.

STARR, MARK ELWOOD (Jun.) (Age 35) Head Architectural Draftsman, Dept. of Labor and Industry, Pennsylvania; Prof. Engr., Selinsgrove, Pa.

STEEN, GEORGE PERRY (Age 36) Associate Prof. of Civ. Eng., Univ. of New Mexico, Albuquerque, N.Mex.

STURDY, HOWARD HENRY (Jun.) (Age 34) Gen. Mgr., Contr. Div., Dravo Corp., Sewickley, Pa.

SUMNER, LAWTON TAYLOR (Age 48) Chf. Engr., Fischer Lime & Cement Co., Memphis, Tenn.

SWANSON, WALFRED ERNEST (Jun.) (Age 35) Engr. and Supt., Gibbons & Reed Co., Salt Lake City, Utah.

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WHITEHURST, GEORGE WEAVER (Age 36) Civ. Engr. P-4 WD, Engr. Service, PHILRYCOM, APO 707, San Francisco, Calif.; Washington, D.C.

WILLIAMS, ROBERT ANGUS (Jun.) (Age 27) with Clark, Dodge & Co., Lisbon, Ohio.

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APPLYING FOR JUNIOR

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CASPARY, GERALD JOSEPH (Age 26) Instructor, Dept. of Civ. Eng., Michigan Coll. of Min. & Tech., Houghton, Mich.

GOLOMBEK, SIGMUNDO (Age 24) Asst. Engr. with Odair Grillo, Cons. Engr., São Paulo, Brazil.

GREEN, MORRIS WILLIAM (Age 26) Design and Constr. Engr., Consolidation Coal Co., Jenkins, Ky.

HODGE, RAYMOND JOSEPH (Age 25) Research Associate, Cornell Univ., Ithaca, N.Y.

JENNY, DANIEL PETER (Age 26) Field Engr., Fluor Bros. Constr. Co., Oshkosh, Wis.

JOHNSON, WALTER ALGOT (Age 29) Structu... Draftsman, American Bridge Co., Elmira, N.Y.

KANAREK, JOSEPH (Age 27) Designer, Gibb... Hill, Inc., New York, N.Y.

LEONARDS, GERALD ALLEN (Age 26) Graduate ... dent and Instructor, Purdue Univ., West Lafa... ette, Ind.

PARE, ROBERT LEE (Age 27) Graduate Stude... Dept. of Civ. Eng., Yale Univ.; previous... (nearly 5 years) with Corps of Engrs., U.S. Arm... Hamden, Conn.

PERKINS, ROBERT LEE (Age 29) Engr., Gene... McClelland, Cons. Engrs., Houston, Tex.

VIEST, IVAN MIROSLAV (Age 25) Graduate Stude... Civ. Eng. Dept., Georgia School of Technolo... Atlanta, Ga.

WELLS, SHERROD PARKER (Age 29) Civ. Engr. ... TVA, Knoxville, Tenn.

WHITE, JOHN FRANKLIN (Age 27) Student Offi... Iowa State Coll., Ames, Iowa.

YARID, ANIS ALEXANDER (Age 25) with Powell... Powell, Engrs., designing and detailing concr... structures for sewage-disposal plant, Dallas, Te...

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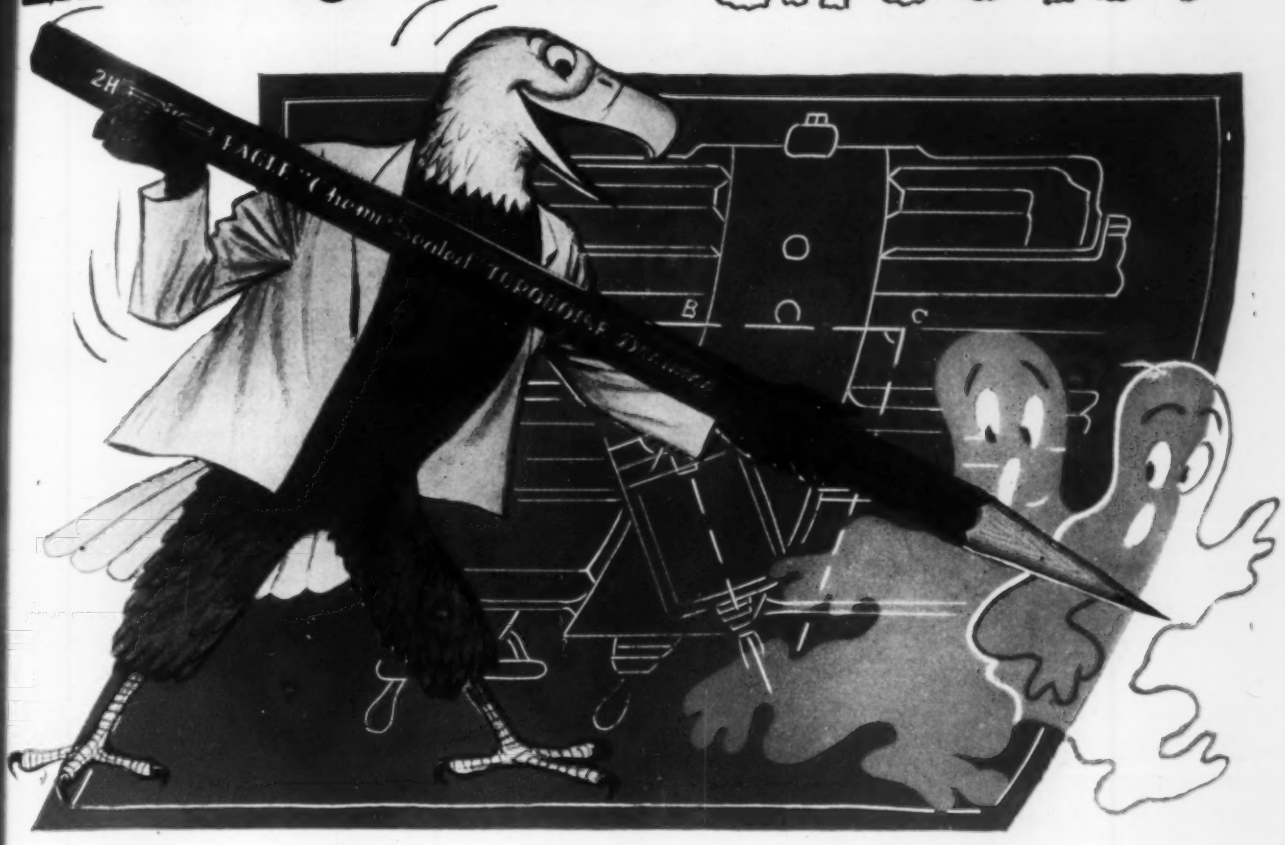

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ADDITIONS, TRANSFERS, REINSTATEMENTS, AND RESIGNATIONS

From March 10 to April 9, 1948

Additions to Membership

Acevedo-Quintana, Francisco (Assoc. M. '48) Cons. Engr., Instituto Nacional de Obras Sanitarias, Reducto a Glorieta #90, Caracas, Venezuela, S.A.

Agnew, Robert Andrew (Assoc. M. '48) Senior Asst. Engr., Municipality of Springs, Town Hall, Springs (Res., 16 Greta Rd., Casseldale, Springs), Transvaal, South Africa.

Alexander, George Leroy, Jr. (Jun. '48) Junior Surveyor, Seismograph Crew, Atlantic Refining Co., Box 241, Franklin, La.

Anderson, Glen Robert (Jun. '47) Civil Engr. I, City of Milwaukee (Res., 3524 West Sarnow St.), Milwaukee 8, Wis.

Atkinson, Matthew John (Jun. '47) 124 West Park, Libertyville, Ill.

Baines, William Douglas (Jun. '48) Research Asst., Iowa Institute of Hydraulic Research, Univ. of Iowa, Iowa City, Iowa.

Banks, William Foster (M. '48) Consultant, Motor Transportation, 20 East 27th St., New York (Res., Glenada Rd., Roslyn L.I.), N. Y.

Bayliss, John Robinson (Jun. '48) Soils Engr., Palmer and Baker, Inc., P.O. Box 346, Mobile, Ala.

Bedford, John Glennon (Jun. '48) Graduate Student, University of Illinois (Res., 1634 Virginia Drive), Urbana, Ill.

Benish, Anthony Andrew (Assoc. M. '48) Asst. Prof. of Civil Eng., The University of Texas, Eng. Bldg. 150-G, Austin, Tex.

Bergerson, Wallace Wilson (Jun. '48) Acting Chf. Engr., Pollution Control Commission, Legislative Bldg., Olympia, Wash.

Berk, William Leo (Jun. '47) Structural Engr., Greeley & Hansen Engrs., 220 South State (Res., 5822 South Albany), Chicago, Ill.

Bettle, Albert Francis (Assoc. M. '48) Asst. Supt., International Boundary & Water Comm., 627 First National Bank Bldg. (Res., 3610 Altura Blvd.), El Paso, Tex.

Blaser, Harold Dean (Jun. '48) Hydr. Engr., State Engrs. Office (Res., 230 F St.), Salt Lake City 3, Utah.

Bleistein, Frank Edward (Assoc. M. '48) Asst. Designer, Howard, Needles, Tammen and Bergendoff, 921 Walnut St. (Res., 3613 Central), Kansas City 2, Mo.

Bleul, George John (Jun. '48) Bridge Draftsman, Baltimore & Ohio R.R., Bridge Dept., Baltimore 1, Md. (Res., 505 Main St., Northport, L.I., N.Y.)

Bond, William Joseph (Assoc. M. '47) Cons. Engr., Atomic Energy Commission (Res., 102 Wade Lane), Oak Ridge, Tenn.

Bornhoeft, Jack Harry (Jun. '48) Asst. Constr. Supt., Gerhardt F. Meyne Co., 7 South Dearborn St. (Res., 7248 West Thorndale Ave.), Chicago 31, Ill.

Bowman, Paul Leslie (Assoc. M. '48) Design Engr., Texas State Highway Dept., P.O. Box 472, El Paso, Tex.

Boyce, Frank Fairbrother (M. '48) Staff Engr., De Leuw, Cather and Co., 20 North Wacker Drive, Chicago, Ill. (Res., Apt. 306, One-Hundred and Ten, St. Clair Ave. West, Toronto, Ontario, Canada.)

Bradakis, Henry Leon (Jun. '48) Asst. San. Engr., Chicago Pump Co., 2350 Wolfram St., Chicago, Ill. (Res., R.R. 3, Dowagiac, Mich.)

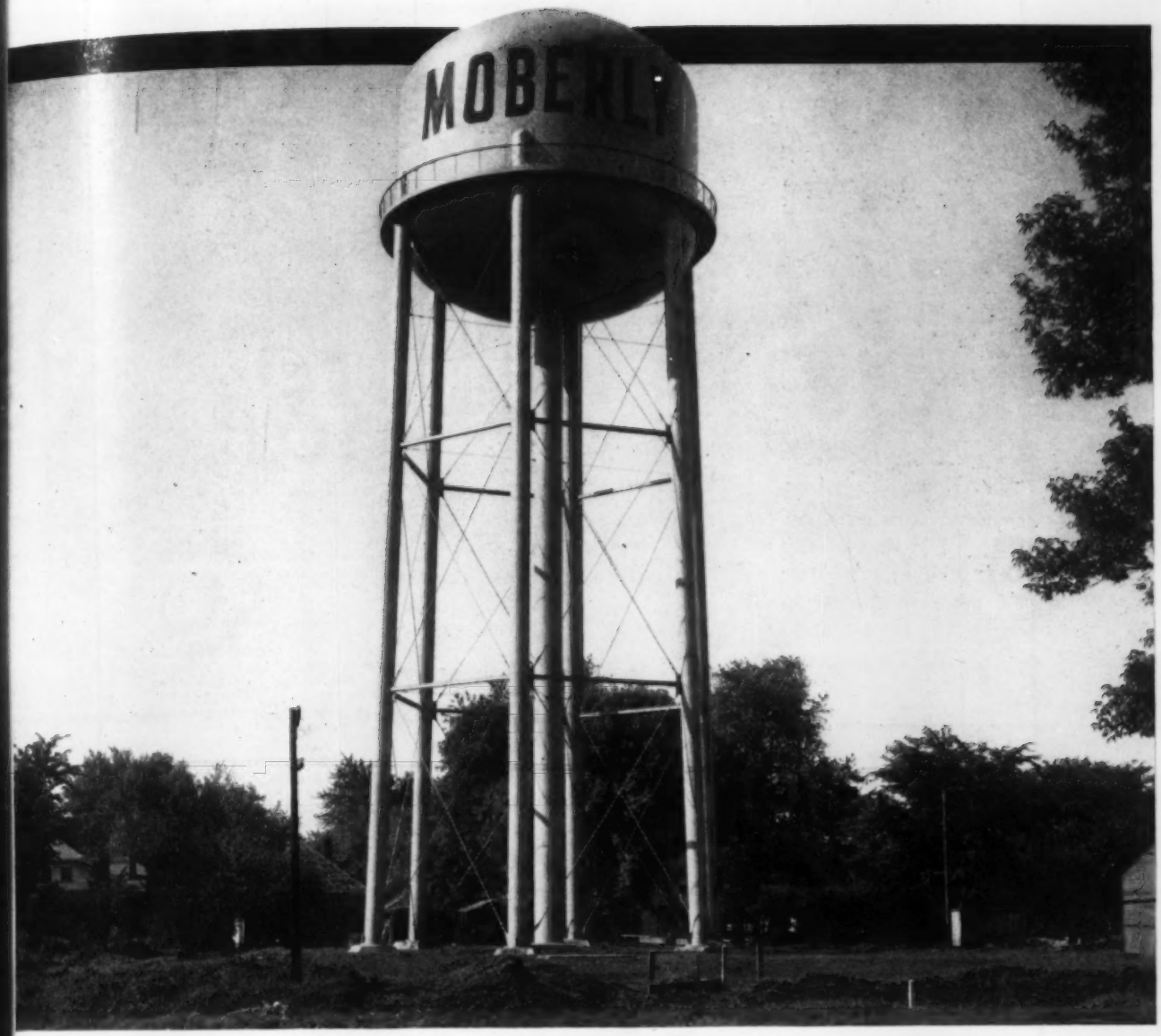
Bradbury, William Edward (Assoc. M. '48) Research Engr., Sheffield Steel Corp., Sheffield Station, Kansas City, Mo.

Bradley, Robert Orin (Jun. '47) Civil Engr., Libbey-Owens-Ford Glass Co., 1701 East Broadway, Toledo (Res., Waterville), Ohio.

Brockway, George Lemuel, Jr. (Jun. '48) Engr. Draftsman, Gen., U.S. Government, Public Works Administration Bldg., Cherry Point (Res., 10 Sunrise Lane, Havelock), N.C.

Brown, John Joseph (Assoc. M. '48) Asst. Bridge Engr., State Division of Highways, Bridge Dept., 402 Wilcox Bldg. (Res., 1809 South Catalina St.), Los Angeles 6, Calif.

Brown, Walter Eastman, Jr. (Jun. '47) Engr., Donora Southern R.R. Co., Donora (Res., R.D. 1, Mononogahela), Pa.



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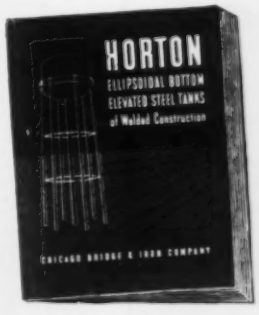

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DAY, JOHN WITHINGTON (Jun. '47) R.F.D. 1, Earlysville, Va.

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DU PLESSIS, JOHN VERNON (Jun. '47) Resident Engr., Lourenco Marques, Delagoa Bay Lands Syndicate, Ltd., P.O. Box 3044, Johannesburg, Africa. (Res., Care, Dr. J. J. du Plessis, 25 Scott St., New Castle, Natal, Union of South Africa.)

DUWELIUS, THOMAS ARNOLD (Jun. '48) Instr., Civil Eng. Dept., Rose Polytechnic Institute, Terre Haute, Ind.

EBBERTS, ALFRED RAYMOND (Assoc. M. '48) Associate Physical Testing Engr., State Div. of Highways Materials and Research Dept., 3435 Serra Way (Res., 1341 Forty-second St.), Sacramento 16, Calif.

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ELMES, WILLIAM THOMAS (M. '48) Asst. Chf. Engr., Pittsburgh & Lake Erie R.R., Pittsburgh 19, Pa.

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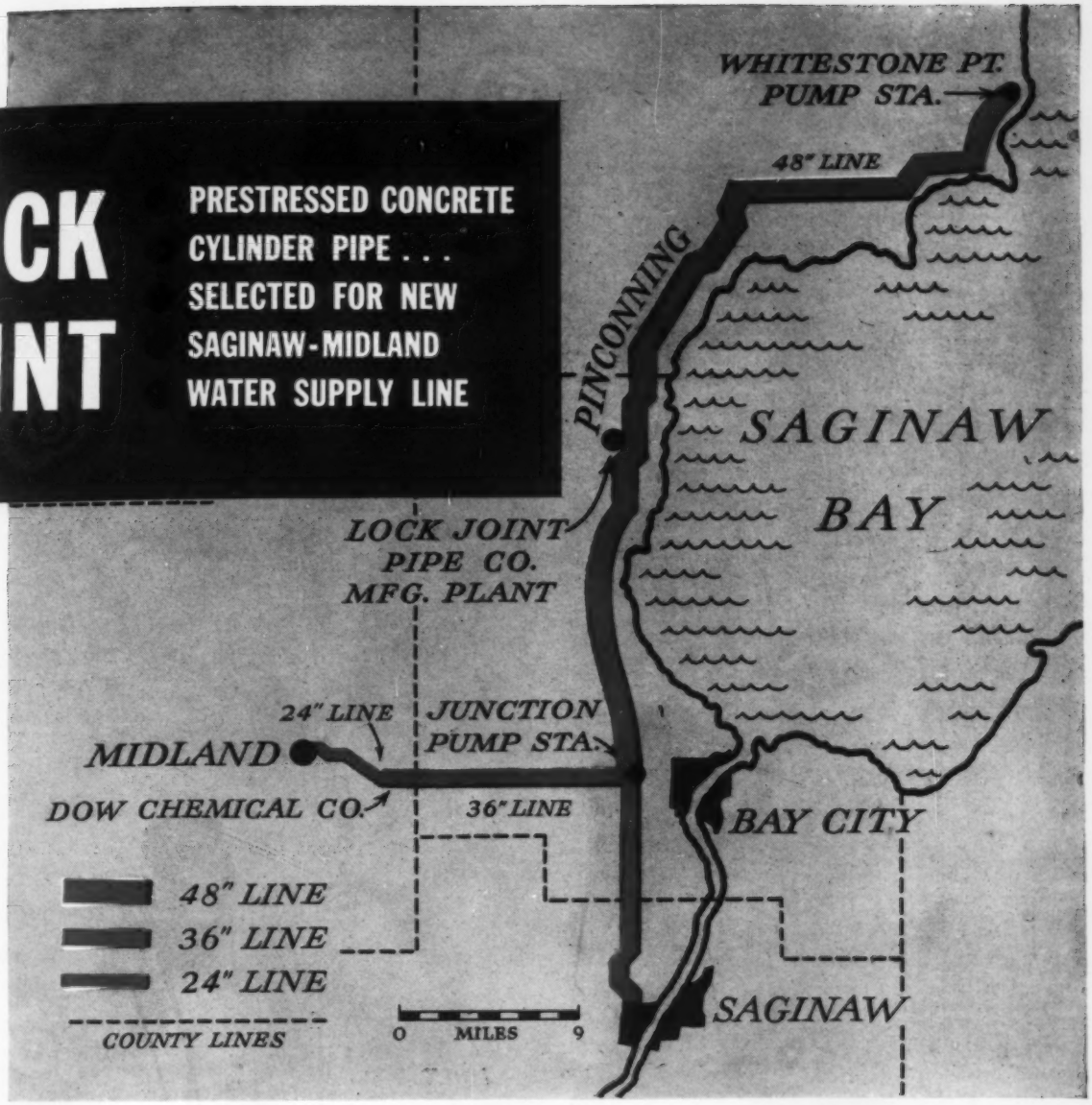

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(*Continued on page 96*)

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PLANT LAYOUT AND CONSTRUCTION ENGINEER. Must know something about costs and must also know how to make drawings and prepare specifications; must know fundamentals of building construction, piping, wiring, heating, ventilating, etc. Location, Indiana. Y-614.

ASSISTANT CONSTRUCTION ENGINEER, 35–40, preferably with practical experience in chain department store operations. Will be responsible for plans, contracts, and final supervision of construction. Considerable traveling. Salary, $7,500 a year. Headquarters, New York, N.Y. Y-619.

ENGINEERS. (*b*) (CNY-641-642-C) Civil Engineer under 50, single status, with an engineering degree and 2 years on highway work or equivalent time in engineering work. Duties will include making locations for roads, compiling data, and drawing up plans for same, supervising construction and maintenance of projects, as well as other details pertaining to highway engineering. Salary, $4,500–$5,200 a year. Will be required to learn Spanish in Venezuela. Y-634.

CONSTRUCTION SUPERINTENDENTS who would handle a refinery construction project running between a million and 2 million dollars in field payroll. Location, northern New Jersey. Y-656.

ASSOCIATION SECRETARY, civil engineer, to take charge of labor relations, etc., for building trade association. Should have some building construction experience and experience in dealing with union labor, etc. Salary, about $8,000 a year. Location, New York Metropolitan area. Y-682.

ASSISTANT SUPERINTENDENT OF CONSTRUCTION. Will represent owner on large housing development. Will be particularly involved in so far as the mechanical side is concerned. Will be responsible for all mechanical inspection. Salary $5,200 a year. Location, New York, N.Y. Y-686.

ENGINEERS. (*a*) Chief Engineer, civil graduate, with 10 to 15 years' experience in heavy construction, particularly highways, roads, bridges, etc. Salary, $12,000 a year. (*b*) Assistant Chief Engineers, with similar experience. Salary, $9,100 a year. (*c*) Senior Civil and Assistant Civil Engineers for field work on highways, roads, bridges, etc. Salary, $6,500–$7,500 a year. Location, Greece, Y-698.

FIELD ENGINEER, 26–40, civil graduate, with 5 years' varied experience in general construction work. Will investigate conditions, report and make recommendations and cost estimates concerning construction such as docks, drilling bases and platforms, roads, bridges, buildings, etc., write specifications, evaluate bids, recommend contractors, requisition materials, etc. Salary, $4,500–$5,100 a year depending on qualifications, plus cost of living adjustment. Location, Texas. Y-704.

SUPERINTENDENT OF ERECTION. Must be capable of taking complete charge of the erection of a high pressure boiler installation and its auxiliaries in Greece. Salary open. Y-717.

CIVIL ENGINEER for small city Department of Parks and Recreation. Salary open. Location, Wisconsin. Y-719.

ASSISTANT MANAGER for engineering and construction department, 34–45, with broad record of field as well as design experience, especially on industrial plant work, and with some experience on office and similar buildings. Work will involve investigating new jobs and various related problems. Salary, $6,000–$7,000 a year depending on qualifications. Location, upstate New York. Y-734.

CIVIL ENGINEER, young, to teach strength of materials. Position starts in September 1948. Salary, $3,000 a year, more if experienced. Location, Rhode Island. Y-738.

ADVISORY SPECIALIST, civil engineer, with 1 or 2 years experience on concrete gravity dams, to check progress of work being done on a concrete gravity dam in Turkey. Temporary, 6 months. Salary open. Y-748.

CIVIL ENGINEER, preferably 28–33, for engineering, repair and maintenance for hydroelectric utility company. Should have good background of hydraulics and hydraulic structures. Salary, $4,000–$4,500 a year. Location, Maine. Y-749.

STRUCTURAL DESIGN ENGINEER with at least 10 years experience in the design of concrete, steel and other structures, including API-ASME code vessel design, and familiar with California building codes. Should be registered in California or able to pass examination. Must be capable of taking charge of design group. Salary commensurate with experience and ability. Write stating personal data, education, and experience. Y-775S.

CITY ENGINEER AND DIRECTOR OF PUBLIC WORKS for city of 15,500. Must have C.E. degree, know sewage and water-works operation. Location, Minnesota. Starting salary, $4,500 per year. R-4891C.

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(*Continued from page 94*)

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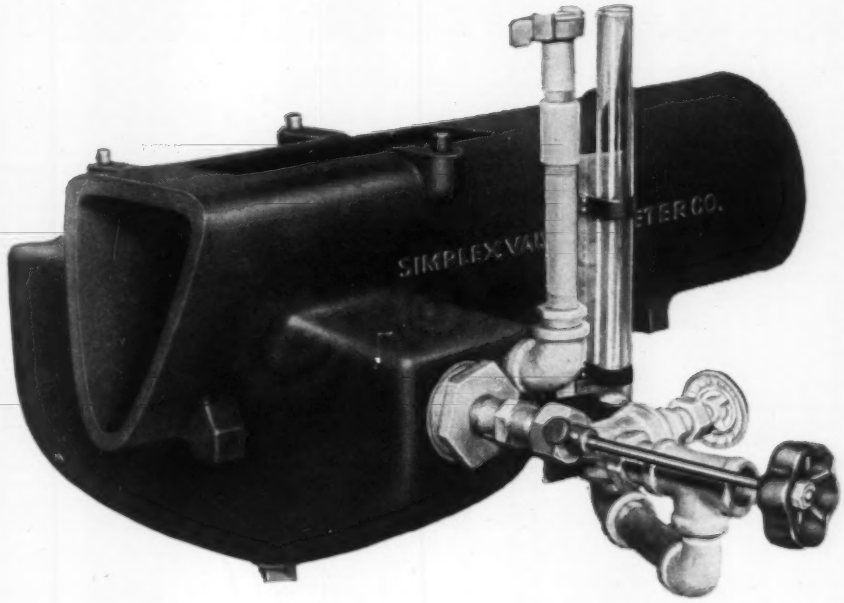

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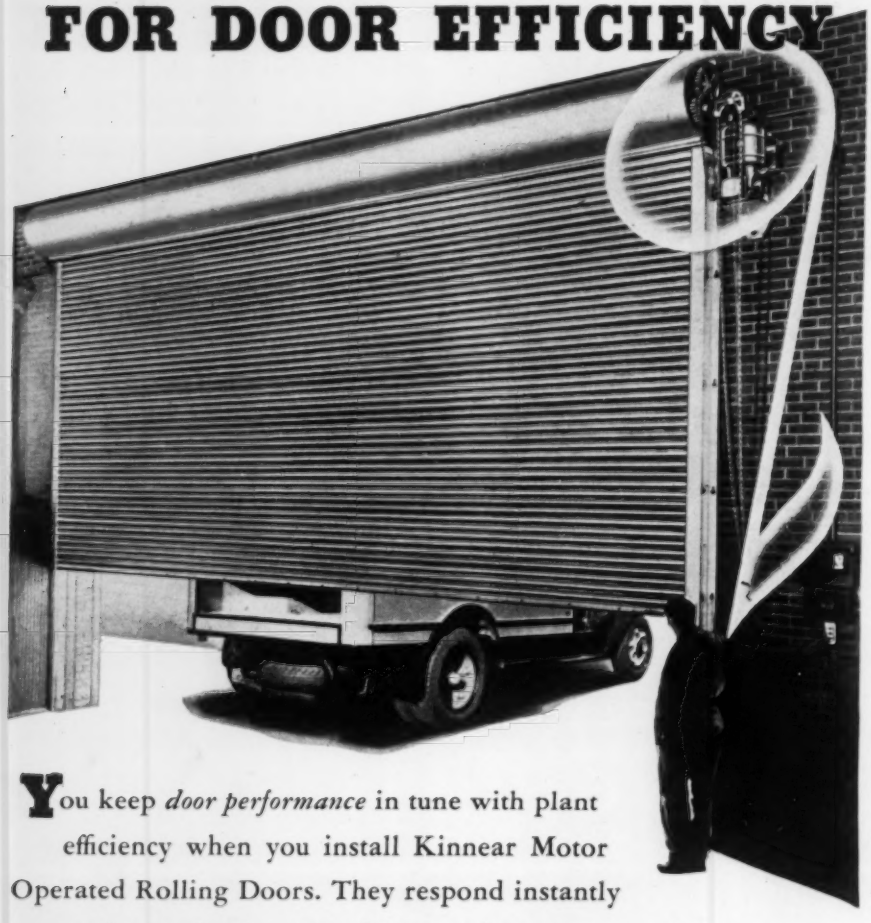

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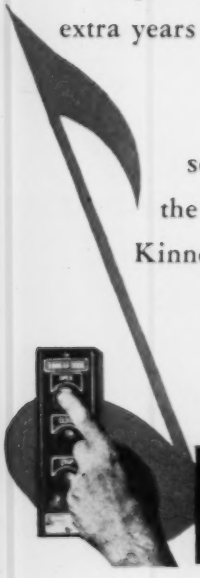

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...E, RAYMOND LEROY (Assoc. M. '32; M. '48) ...tired); 304 North Moore Road, Chattanooga, ...n.

...RIS, BROOKS THERON (Jun. '34; Assoc. M. ...) Chf. of Power Plant Section, Research and ...velopment Div., General Tire & Rubber Co. of ...if., 1030 East Green St. (Res., 924 North ...e.), Pasadena 6, Calif.

...TON, JOHN JESSE (Jun. '37; Assoc. M. '48) ...st. Mgr., John W. Ryan Const. Co., Inc., 369 ...ington Ave., New York (Res., 118-26 Two ...ndred and Thirtieth St., St. Albans 8), N.Y.

...AN, ARTHUR CHARLES (Jun. '34; Assoc. M. ..., M. '48) Director, Service, Supply & Procure...nt, Sandia Base, U.S. Army, Box 5100, Albu...rque, N.Mex.

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PRAY, FRANCIS ELLARD (Jun. '44; Assoc. M. '48) Civil Engr. II, Tennessee Valley Authority, 518 Union Bldg., Knoxville, Tenn.

RICHTER, VICTOR JOHN (Assoc. M. '36; M. '48) Cons. Engr., 8511 Colesville Rd. (Res., 107 Lexington Drive, Woodmoor), Silver Spring, Md.

RIESBOL, HERBERT SPENCER (Jun. '29; Assoc. M. '41; M. '48), Asst. Chf. Hydrology Div., Branch of Project Planning, Bureau of Reclamation, Denver Federal Center (Res., 2329 Clermont St.), Denver 7, Colo.

SCHLUP, TRUMAN BANKSON (Assoc. M. '42; M. '48) (Truman Schlup, Cons. Engr.), 327 Public Levee Terminal, 1401 Fairfax Traffic Way, Kansas City 15, Kans.

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SMITH, SAMPSON CARGILE (Assoc. M. '43; M. '48) Dist. Engr., State Dept. of Works, Baton Rouge (Res., Box 696, Tallulah), La.

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STEFFES, ARNOLD MICHAEL (Assoc. M. '29; M. '48) Chf. Design Engr., Utilities, Toltz King & Day Inc., 1509 Pioneer Bldg. (Res., 791 Lincoln Ave.), St. Paul 5, Minn.

STEVENS, VICTOR GEORGE (Jun. '37; Assoc. M. '48) Naval Officer, Civ. Engr. Corp., United States Navy, Navy Dept., Washington 25, D.C. (Res., 5362 Quincy Pl., Apt. 101, Bladensburg, Md.)

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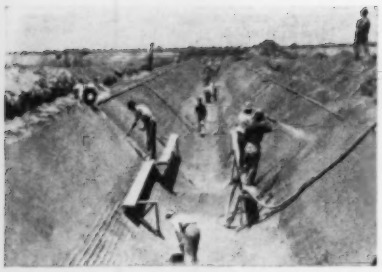

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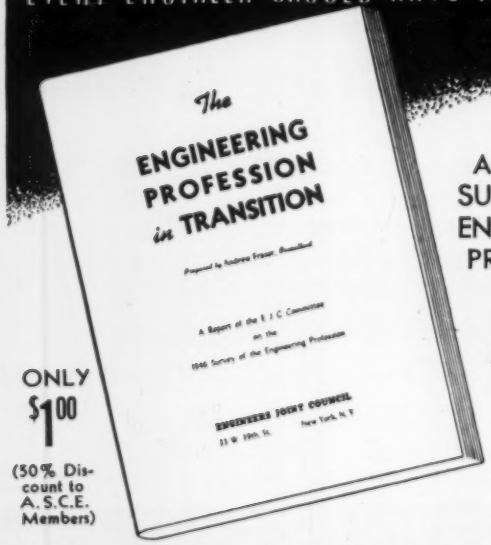
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TYLER, JACK HENNIGAN (Jun. '35; M. '48) Executive; Civil Works, Office, Chf. of Engrs., U.S. Army, Room 2339, Bldg. T-7, Washington, D.C. (Res., 110 North Thomas St., Arlington, Va.)

UNDERHILL, HENRY WILLETS (Jun. '37; Assoc. M. '48) Jericho, L.I., N.Y.

WHIPPLE, HORTON (Assoc. M. '29; M. '[illegible]) (Thomas & Whipple), Palo Alto, Calif.

WITTE, HERBERT WALTER (Jun. '37; Assoc. M. '48) Engr. Constr., Corps of Engrs., Dept. of the Army, Box 112, Paintsville, Ky.

WYNNE-EDWARDS, ROBERT MEREDYDD (Assoc. M. '27; M. '48) Director, Richards Costain Ltd., Dolphin Square, London S.W.1., England.

YANK, HERMAN VICTOR (Jun. '45; Assoc. M. '[illegible]) Structural Engr., Horn and Mortland, 1244 'O' St., Fresno, Calif.

Reinstatements

ALTWATER, HERBERT GEORGE, Assoc. M., 210 S[illegible] Flower St., Apt. 114, Los Angeles, Calif., reinstated Mar. 29, 1948.

ANASTASSIADIS, DIMITRIOS THEMISTOCHES, Assoc. M., 41 Stournara St., Athens, Greece, reinstated Apr. 2, 1948.

DODGE, BERT EMERSON M., Structural Engr., Universal Atlas Cement Co., 135 East 42nd St., New York 17, N.Y., readmitted Feb. 16, 1948.

DORITY, ALEX OUSLEY, M., Comdr., U.S. Navy (David Taylor Model Basin (Res., 4432 South 36 St., Arlington, Va.) readmitted Feb. 16, 1948.

HATFIELD, ROBERT JOHN, Assoc. M., 2202 Montezuma Ave., Alhambra, Calif., reinstated Apr. 1948.

HUDDLESTON, PAUL MCKISSON, Assoc. M., C[illegible] Structural Engr., Reynolds, Smith & Hill, Archts. & Engrs., 227 Park St. (Res., 3221 Twe[illegible] St.), Jacksonville 5, Fla., reinstated Mar. [illegible] 1948.

KOCH, ALBERT ARTHUR, M., Acting Head of th[illegible] Eng. Dept., New Mexico School of Mines (Res. P.O. Box 601), Socorro, N.Mex., readmitted Feb. 16, 1948.

METCALF, RALPH LESLIE, Jun., 1533 Silver St., Jacksonville, Fla., reinstated Mar. 19, 1948.

MORT, LINWOOD GEORGE, M. (Argraves & Mo[illegible] Engrs.), 70 College St., New Haven, Conn., [illegible] admitted Feb. 16, 1948.

NYGREN, HARRY FRANK, Assoc. M., c/o Gener[illegible] Motors Corp., Argonaut Realty Division, 6[illegible] West Milwaukee, Detroit 2, Mich., reinstated Apr. 5, 1948.

PFEILER, ARNO JOSEPH, Assoc. M., 2814 Ste[illegible] Ave., Overland 14, Mo., reinstated Mar. 31, 19[illegible]

RENNER, WALTER ADOLF, Jun., 764 George Ave., Aurora, Ill., reinstated Mar. 8, 1948.

SCHAD, JAMES ALBERT, Assoc. M., American Iron and Steel Inst., 350 Fifth Ave., New York 1, N.Y., reinstated Mar. 24, 1948.

VALERI, HUGO BONAVENTURE, Assoc. M., Sec[illegible] Columbia Home Builders, Inc., 121 South Washington St., Falls Church (Res., 4209 Thirty-[illegible] St. South, Arlington), Va., readmitted Feb. 1948.

WALDREP, JUDGE SCOTT, Assoc. M., Cons. Eng[illegible] (J. S. Waldrep Cons. Engr.), 21 West Main St., Oklahoma City, Okla., reinstated Apr. 1, 19[illegible]

Resignations

DECKER, WILMOT HUNTER, Jun., Homestead Ro[illegible] Lynnfield Center, Mass., resigned Mar. 10, 19[illegible]

KANTZ, RALPH CLAYTON, JR., Jun., Care, Dept. Planning & Public Works, County Courthou[illegible] Santa Barbara, Calif., resigned Mar. 15, 1948.

KING, KARL KENNETH, Jun., 200 Caldwell St., Auburn, Ill., resigned Mar. 9, 1948.

KOWITZ, ARTHUR WILLIAM, Assoc. M., 101 N[illegible] Main St., White Hall, Ill., resigned Mar. 9, 19[illegible]

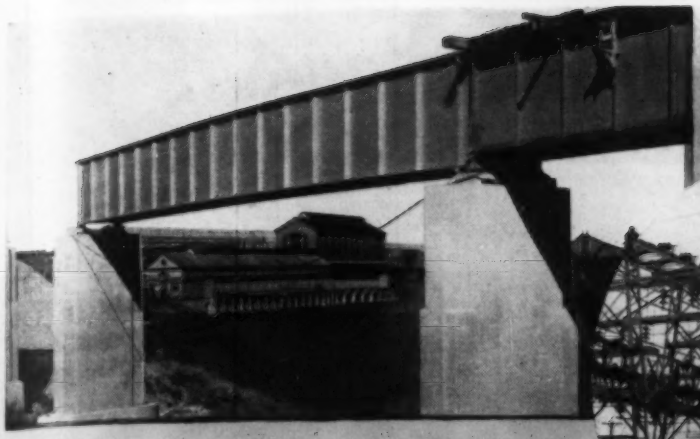
MCDARGH, CHARLES DERBY, Assoc. M., [illegible] Fredericksburg Rd., San Antonio 1, Tex., resigned Mar. 9, 1948.

NAVIS, HERBERT ALBERT, Jun., 2311 St. Fra[illegible] Drive, Palo Alto, Calif., resigned Mar. 10, 19[illegible]

OHMAN, RICHARD NELSON, Assoc. M., 3041 T[illegible] teenth Ave., South, Minneapolis 7, Minn., resigned Mar. 9, 1948.

ROGERS, LAWRENCE WINCHESTER, Jun., 5605 D[illegible] chester, Chicago 37, Ill., resigned Mar. 9, 19[illegible]

TILLMAN, DONALD CALVIN, Jun., 1498 Sinaloa M[illegible] Pasadena 7, Calif., resigned Mar. 10, 1948.



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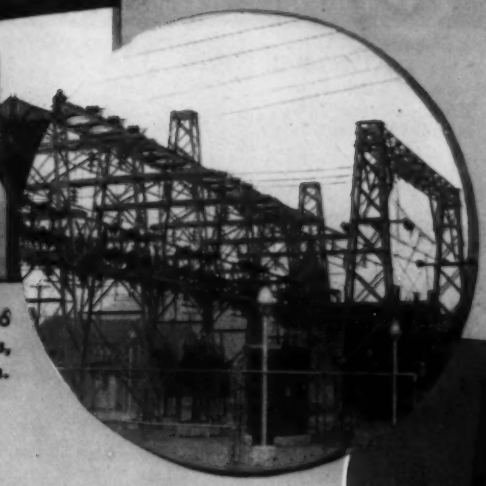

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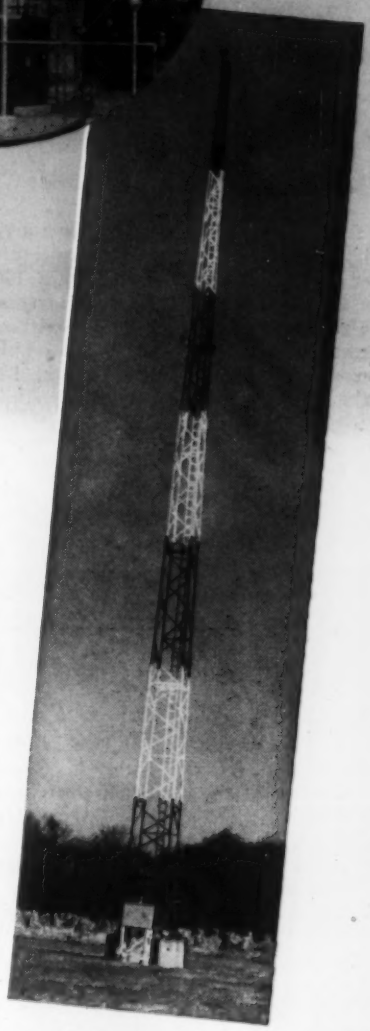

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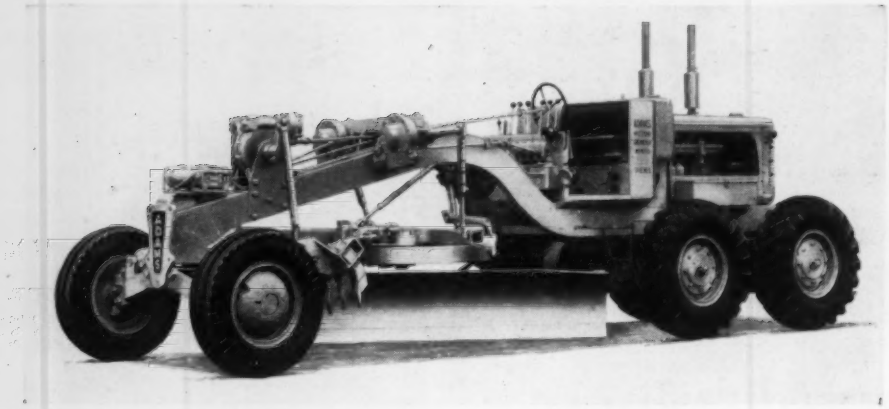

THE NEW No 610 motor grader, the result of five years of extensive testing is now in production. Powered by a 100-hp UD-16 International diesel engine, the grader weighs over 25,000 lb without accessories. With over 18,000 lb on the rear wheels ample traction is provided to make full use of the 100-hp engine. Easy operation is made possible by the use of a combination mechanical-hydraulic steering mechanism which gives all the advantages of mechanical steering with power doing all the work. This power steering plus push-button cab controlled electrical starting is furnished as standard equipment. Other features of the machine include: full-floating rear axle (axle drives machine only, carries no weight); a 12-ft blade 31 in. wide enabling the machine to fully utilize its power by carrying a greater load; 8 forward speeds ranging from 2.6 to 25.2 mph; hydraulic brakes on all 4 tandem drive wheels; 14 to 24 tires on tandem and 11 to 24 tires on front wheels for better traction and flotation; a new two-piece cab that provides 6 ft $3\frac{1}{2}$ in. inside cab height and new, improved power controls that not only give easier operation but greatly increase the blade lifting speed. **J. P. Adams Mfg. Co., Indianapolis, Ind.**

Fire Retardant Wood

WOOD THAT resists fire has solved a unique construction problem for a large Pittsburgh department store. More than 100,000 fbm of yellow pine lumber, pressure-treated with special fire resistant chemicals, have been used at the Joseph Horne Co. to raise 20,000 sq ft of flooring to a new level 16 in. higher than the old. The problem faced by officials of the department store was to raise the 20,000 sq ft of floor 16 in. so that its level was the same as that of the rest of the second floor. The floor levels were different because, originally, parts of the store were two different buildings. Steps had been used to get from one level to the other. Various construction methods were studied. The fire retardant wood construction was agreed upon as best for the job. With this material, the raised floor and its supports weighed less than that of the original materials removed from the old floor.

Making wood into a material which refuses to carry flame is accomplished through a special process. The wood is loaded on small cars which are run into a huge treatment cylinder. The door of the cylinder is bolted shut so that the cylinder becomes air tight and the air in the chamber is then pumped out, creating a partial vacuum. From large tanks above the cylinder, the treating chemicals in water solution are then let down until the wood is completely surrounded. With air evacuated from the very fibers of the wood, the solution penetrates deeply. Then in order to get even deeper penetration, the vacuum is broken and air pumped into the chamber until a pressure of 200 lb per sq in. is reached. This pressure is maintained for about three hours. At the end of this treatment, the chemicals that repel fire have so thoroughly penetrated the fibers that a high percentage of the wood is saturated with it. Upon drying, the wood so treated becomes a permanent fire retardant material. The chemical also repels termites and rot-causing fungi. **Koppers Company, Inc., Pittsburgh 19, Pa.**

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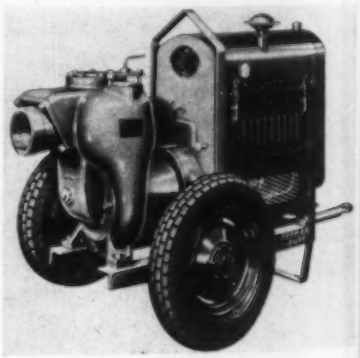
Contractors' Pumps

A COMPLETE NEW line of centrifugal self-priming contractors' pumps will be publicly shown in July at the National Road Show, Chicago, Ill. Emphasized are important refinements in the patented design which incorporates quick-positive priming features without the use of valves, vents, or any mechanical devices. These new pumps have high-speed priming at all suction lifts at Contractors' Pump Bureau ratings. Included in the line are pumps from the 7M 2-in. to the 125M 8-in. for use in the construction, mining, municipal, farming, oil producing, marketing, and industrial fields. The following are



among the pumps to be placed on display: 7M base and wheel barrow mounted; 7M and 10M pneumatic tire mounted; 40M air-cooled engine, low speed trailer-mounted; 40M water-cooled engine, high-speed trailer mounted; 90M steel wheel mounted, Hercules engine, OSC (odorless sanitary cleaner) unit. **Gorman-Rupp Co., Mansfield, Ohio.**

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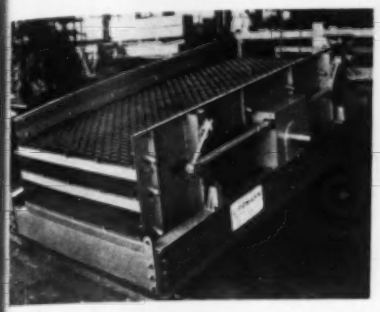
A NEW POSITIVE eccentric vibrating screen, the Screen-All, offers a revolutionary method of imparting vibration permitting perfect balance of forces. Instead of using an eccentric shaft, patented eccentric hubs are mounted on a straight shaft. The hubs can be perfectly counterweighted, and there are no offset stresses in the shaft. Together with the positive vibration equalizer, which transmits equal vibration to every square inch of all decks, this absence of unbalance forces during



the complete operating cycle eliminates transmission of any vibration to the supporting structure without the use of side or end springs or guy cables. The perfect circular motion permits higher capacities and sharper sizing action. Each particle has greater tumbling and presents all its faces to the screen cloth more often. The greater component of force perpendicular to the decks achieves maximum bed stratification and less blinding. Another Screen-All feature is the mounting of both bearings outside the screen body, only $^{7}/_{8}$ in. apart. This compares to the 3 to 5 in. spacing on all other screens. Consequently, the shaft bending moment is reduced nearly to zero. The outside mounting also permits locating the shaft close enough below the deck to save up to 6 in. headroom. The Screen-All is available in single and multi-deck types in all sizes. **Lippmann Engineering Works, Milwaukee 14, Wis.**

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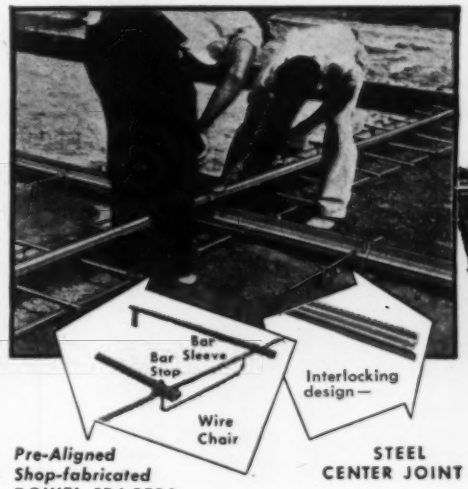

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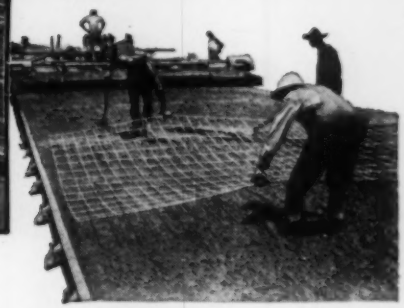

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NOW IN PRODUCTION is a complete line of cable-controlled tractor equipment including bullgrader, bulldozer, scraper, and ripper especially designed for the new International TD-24 crawler tractor. Engineered to move more dirt per hp, these TD-24 attachments have been tested and fully proved in the field. The construction of every one of the machines is balanced to make the most of TD-24 power with minimum stress on tractor or attachment. High-test steel castings, poured in Bucyrus-Erie's own foundry and tested in its metallurgical laboratory, are used in combination with weldments. Cable and sheaves are protected by steel guards. Cable reeving is uncomplicated,

and sheaves are large, mounted on roller bearings, and placed well out of the way of dirt. All parts are easily accessible for servicing. Full visibility is one of the most important features of the bullgrader and bulldozer. With compact radiator guard and sheave support set close to the sides of the tractor and the upper bar close to the engine hood, the operator can see everything that the blade is doing. This results in greater speed and more accurate control, the manufacturer states. The new scraper, called the B-250, has a struck capacity of 22 cu yd. Low center of gravity makes for speed and stability in

field operation. Differential bowl and apron reeving keeps rope pulls low while giving maximum power at the start of the positive rolling ejection dump. The scraper's apron can easily be converted from the conventional solid type to a hinged type for fast ejection of even the stickiest materials. Other B-250 features are: exclusive double-curve cutting edge which "boils" dirt upward into the apron and bowl with minimum compacting; front-mounted hoist tackle and wide-spread rear wheels for maximum stability.

The heavy duty ripper, Model CR-4, is ideal for breaking up tough-digging, hard-loading materials. It has detachable alloy steel standards, angled for natural digging suction. V-shaped rear end and proper spacing of standards allow ample clearance

M H

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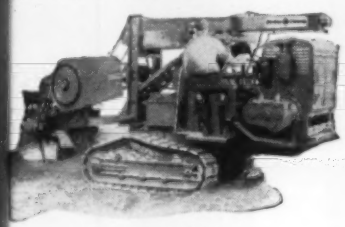
up-rooted materials. Power for the TD-24 tractor equipment is controlled either a front-mounted or rear-mounted wer controlled winch. The front-ounted winch, designed especially for the D-24, is a single-drum unit for bull-ader or bulldozer control. The rear-ounted winch is double drum and can be ed with bullgrader, bulldozer, scraper, pper, or other attachments. Both nches have planetary drive which elimi-tes the need for frequent adjustments. cyrus-Erie Co., South Milwaukee, Wis.

Three-Position Boom Ditchers

Two DITCHING machines designated as e B-G 710 and 720 ditchers feature any advancements plus new develop-ents that include the B-G three-position om which is quickly adjustable (left, nter or right) to dig close to obstructions.

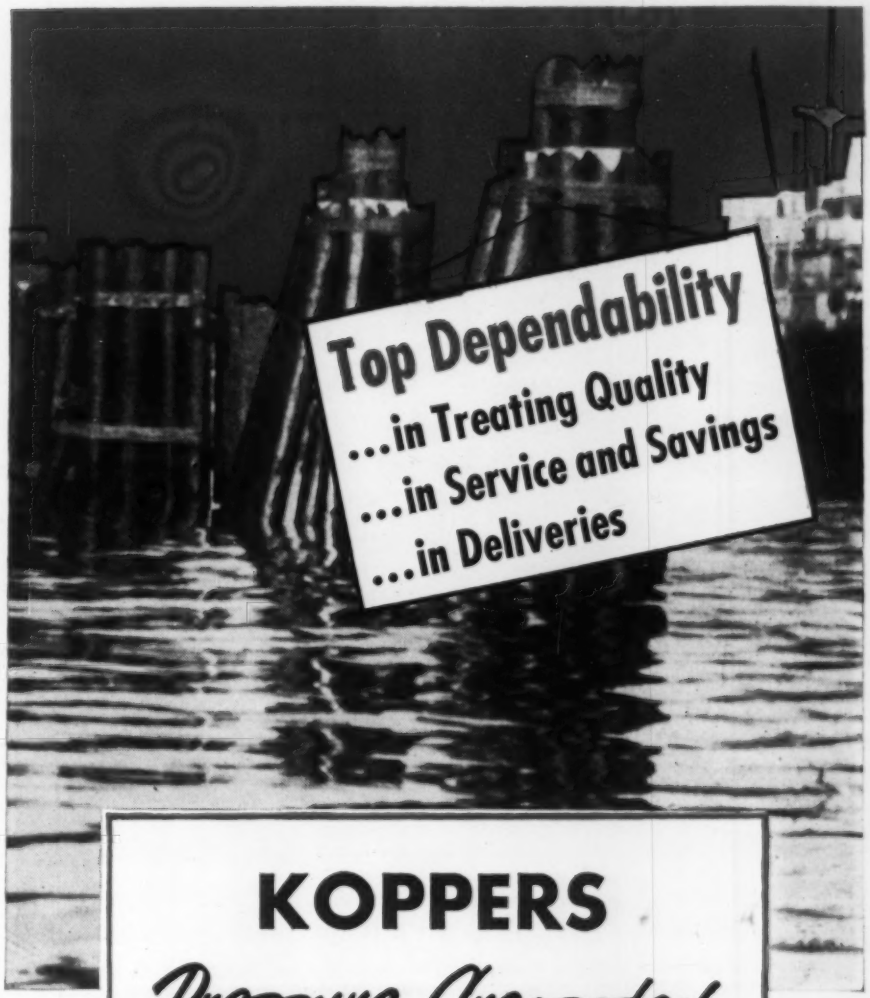


720 Ditcher

he B-G model 720, for digging trenches in. to 11 in. wide and up to 4 ft in depth, corporates the advantages of the verti-l boom design with the new three-posi-on feature that allows boom adjustment make possible closer adherence to the gging line. The vertical boom digs raight down, leaves no ramp. Its self-eaning buckets cut like a milling machine to toughest ground, minimize service, d maintenance expense. Digging eeds are as high as 32 fpm, travel speeds nge to 234 fpm. Spoils conveyor is ad-stable to either side. Designed for gging trenches up to $5^1/_2$ in. wide and in. deep, the model 710 is a cost-re-cer in extending gas, water, and elec-ic lines. Compact, easily and quickly ansported by truck, it has digging speeds to 32 fpm. A special cable-laying tachment is available for feeding cable d plowing over the spoil in one con-uous pass. It incorporates the bene-ts of the three-position vertical-boom de-gn, self-cleaning, milling-action buckets, d other features found in the model 20. Both machines are equipped with e patented B-G overload release that events damage from heavy boulders, c. Booms are equipped with hydraulic ists for power lift and controlled gravity wering. Barber-Greene Co., Aurora, l.

Arcmeter

An Arcmeter, MODEL B, makes it pos-ible to draw or check radii as small as 0 in. Having a range of radii from 20 to infinity, this model will enable drafts-en to utilize the Arcmeter method on uch smaller radii than was formerly ossible. On radii between 20 in. and



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Tower Attachment for Mixer

A SPECIAL TOWER attachment for discharging bituminous mix above ground is adaptable to either the 10-cu ft or 14-cu ft standard bituminous mixer. The tower attachment answers the problem of loading bituminous material from a ground level mixer into trucks or for stockpiling. Discharge height is 7¾ ft for the No. 10 and 8¾ ft for the No. 14. Operated by

a special hoist, the loader is fully controlled by a single lever located on the operators platform. The hoist is mounted within frame and powered by the mixer motor. Hoist clutch is disengaged automatically when bucket reaches discharge position. Fitted with the tower attachment, the bituminous mixer sets up in any location to fit varying production requirements. The tower is quickly collapsed and positioned for ample road clearance in moving machine from one location to another. **Kwik-Mix Co., Subsidiary of Koehring Co., Milwaukee, Wis.**

Vertical Drive Unit

NEWLY AVAILABLE "Vertical Synchronous Motor Magnetic Drive Unit" gives smooth adjustable speed control for centrifugal pumps. Motor drives the ring of the magnetic drive at constant speed. Magnet member of magnetic drive mounted on gear shaft operates the pump at speed required by liquid level control. Unit offers smooth, wide-range speed control, precludes "hunting" and eliminates frequent motor starts and stops. **Electric Machinery Mfg. Co., Minneapolis 13 Minn.**

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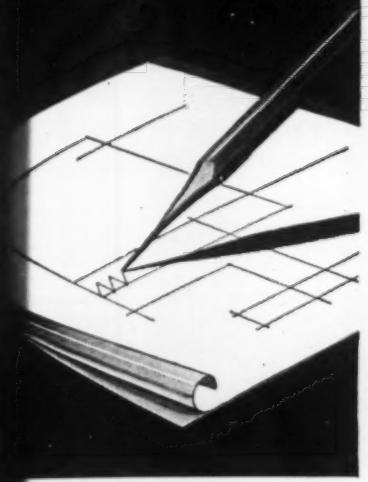

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Literature Available

NEW GRATING CATALOG—A new catalog illustrating and explaining the uses of all types of riveted and welded open steel and aluminum flooring, grating, stair treads, catwalks, and structural steel walkways has just been published. **Wm. F. Klemp Co., 6610 S. Melvina Ave., Chicago 38, Ill.**

TUNNEL LINERS—Steel liner plates which make possible the economical building of tunnels in all ground conditions are described in a 38-page folder. Tables and charts, in addition to pictures and text, are employed to explain the uses and features of the liner plate system. **Commercial Shearing & Stamping Co., Youngstown, Ohio.**

CONCRETE CONSTRUCTION PRODUCTS—A circular describing many diversified Universal products for concrete construction includes various types of anchors, form clamps, the spiroloc cone nut assembly, accessories such as screed chair, bar chair, continuous high chair, slab bolster, and beam bolster. A section explains how the Uni-Form system of wall construction meets varied construction requirements. **Universal Form Clamp Co., Chicago 51, Ill.**

SAND, GRAVEL AND STONE MACHINERY—"Link-Belt Machinery for Handling and Preparing Sand, Gravel, Stone" is the title of a 64-page book covering all types of elevators and conveyors (bucket, apron, belt, screw, flight); a full line of vibrating and revolving screens; various types of washing and dewatering units, including the Link-Belt Rotoscoop; mobile shovel; cranes, draglines; portable conveyors; loading spouts and gates; the Link-Belt Electrofluid Drive, chain drive, speed reducers, variable speed changers, etc. **Link-Belt Co., 307 N. Michigan Ave., Chicago 1, Ill.**

WELDED CONSTRUCTION—A pamphlet of such form that it can be placed under a desk glass or thumbtacked to a drawing board for quick reference offers guidance to the designer of welded construction. Included are arc welding symbols, suggestions for better welded design, properties of weld metals, practical applications of AWS symbols and safe allowable loads for fillet welds. **Lincoln Electric Co., 12818 Coit Road, Cleveland 1, Ohio.**

COLOR GUIDE—A guide devoted to the scientific use of colored pencils in industry and business, with a section called "Engineering—Architecture—Building," is now available. The "Color Systems in Business" guide is something new to assist in the selection of the best colors for charts, graphs, records, etc. **Eberhard Faber Pencil Co. 37 Greenpoint Ave., Brooklyn 22, N.Y.**

REPAIRS TO UNDERPASSES—The repair of concrete underpasses with Gunite is set forth in a 4-page folder showing many pictures of actual jobs. The advantages gained in using Gunite and the procedures followed for each job are included. **Pressure Concrete Co., Newark, N.J.**

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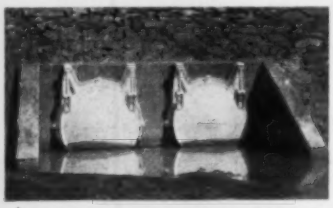

Fig. B-124-D

Two 60" Type M Gates on Relief Culverts near Woodward Pumping Station, Plymouth, Pa.

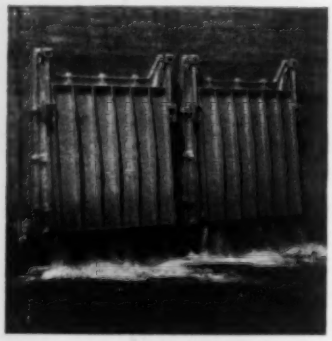

Fig. B-124-C

Two 72" x 72" Type M-M Gates on Toby Creek Outlet Works, Plymouth, Pa.

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Films Available

SCRAPERS—"Material on the Move," a 16-mm full color movie with sound, highlights the application of Caterpillar scrapers over a full range of earthmoving operations. The film is produced by The Galvin Co., Inc., with photography by Caterpillar cameramen. Of particular interest are overhead and worm's-eye views showing the complete action when loading and unloading the scrapers. The design and operation of the scrapers, moved by diesel track-type tractors and wheel-type, off-road tractors, are supplemented by scenes of actual job applications of the equipment. The movie gives a colorful depiction of stripping, cutting, and levelling applications of the tractor-scraper units, working both with and without push tractors. **Caterpillar Tractor Co., Peoria 8, Ill.**

MOTION PICTURE BOOKLET—A 24-page booklet giving complete descriptions of Westinghouse sound motion pictures and slide films available for industrial and civic use has been released. Four colored and twelve black and white sound movies, plus eight black and white films are loaned free except for cost of transportation. Subjects covered include electronics, electricity, radio, RF heating, research, industrial maintenance, safety, vitamins, and nutrition. Also offered are four slide-film instruction courses,broken down into separate lessons that deal with resistance welding control, electrical measuring instruments, electronics, and RF heating. **Film Section, Westinghouse Corp., P.O. Box 868, Pittsburgh 30, Pa.**

P&H STABILIZER—Of interest to all construction men, and particularly highway officials and road builders, is a new sound motion picture of the P&H Single Pass Soil Stabilizer. Filmed in full color, the picture covers all phases of this P&H product. It shows and explains the operation of the machine and how it performs all stabilizing operations in a single pass. There are scenes from various sections of the country showing the Stabilizer at work, using on-the-spot materials. Close-up shots clearly reveal how machine shaves and pulverizes the in-place material, blends, applies the liquid, final mixes and spreads to a uniform depth. **Harnischfeger Corp., Milwaukee 14, Wis.**

SOIL-BITUMINOUS STABILIZATION—A new sound motion picture on the P&H Single Pass Soil Stabilizer has just been completed. The picture shows P&H Stabilizers at work on several soil-bituminous road projects in this country. It is filmed in full color and shows how the machine operates, using on-the-spot materials. The 16-mm picture runs for 22 min. This is the second motion picture to be made on this product, another, described above, on soil-cement stabilization having been released last year. Either or both films are available without cost. **Harnischfeger Corp., Milwaukee 14, Wis.**

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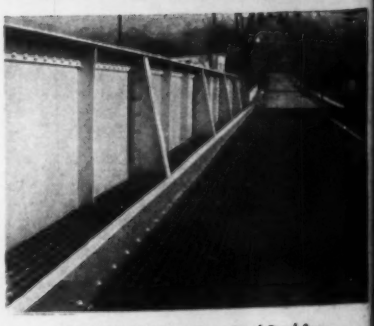

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